AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 | 11

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0003	17-Sep-2003	W16ROE-3210-9068	DACA51-03-B-0023

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
USA ENGINEER DISTRICT, NEW YORK ATTN: CENAN-CT ROOM 1843 26 FEDERAL PLAZA (DACA51) NEW YORK NY 10278-0090	DACA51	**See Item 6**	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. DACA51-03-B-0023
	X	9B. DATED (SEE ITEM 11) 21-Aug-2003
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [X] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

CONSTRUCTION OF FY03 CONSOLIDATED FLIGHTLINE OPERATIONS FACILITY,McGUIRE AIR FORCE BASE, WRIGHTSTOWN, NEW JERSEY

The purpose of the amendment is to revise the bidding schedule, drawings and specifications and to respond to questions from prospective bidders.

The hour and date set for bid opening is extended to 24 September 2003 at 3:00 p.m. EST.

NOTE: Bidders are required to acknowledge receipt of this amendment by the date specified in the solicitation (or as amended) by one (1) of the following methods: on the space provided on the SF Form 1442b; by separate letter or telegram; or by signing Standard Form 30, Blocks 15a, 15b and 15c. FAILURE TO ACKNOWLEDGE THE AMENDMENT(S) BY THE DATE AND TIME SPECIFIED MAY RESULT IN THE REJECTION OF YOUR BID IN ACCORDANCE WITH THE LATE BIDS, LATE MODIFICATIONS OF BIDS OR LATE SUBMISSION OF BIDS.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)	16C. DATE SIGNED 17-Sep-2003

SECTION SF 30 - BLOCK 14 CONTINUATION PAGE

The following have been added by full text:
AMEND 0003

AMENDMENT 0003 TO THE BID SCHEDULE, DRAWINGS AND SPECIFICATIONS FOR FY03 C17 Consolidated Flightline Operations Facility, McGUIRE AFB, NEW JERSEY - DACA51-03-B-0023

TO OFFERORS

The following changes shall be made to the drawings and specifications.

BID SCHEDULE

REPLACE the original Bid Schedule with the new Bid Schedule that accompanies this Amendment.

DRAWINGS

1. The following drawings have been **REVISED** and **REISSUED** with this amendment:

   C-11, WATER AND SEWER DETAILS
   C-12, HIGH TEMPERATURE HOT WATER DETAILS

2. The following drawings have been ADDED with this amdendment.
   Geotechnical Boring Location Plan

3. The following DRAWINGS have been **REVISED** but not **REISSUED**:

   M-301, MECHANICAL SCHEDULES –1; The heat exchanger shell side water temperatures are **REVISED** to read EWT of 180 degrees F and LWT of 200 degrees F. The schedule currently shows the numbers reversed.

   P-101, SANITARY SEWER; Sanitary Sewer #1 invert on West side of building is hereby revised to read 33.45M.

   A-601, FINISH SCHEDULES AND LEGENDS, **REVISE** rooms 248 and 249, the door/ window trim finish to read PT-2.

SPECIFICATIONS

1. Specification sections that have been **REVISED** and **REISSED** are as follows:

   Table of Contents (TOC); **REPLACE** the original TOC with the new TOC that accompanies this Amendment.

2. Specification sections that have been **DELETED** without replacement are as follows:

   SECTION 08520N - ALUMINUM WINDOWS

3. Specification sections that are **ADDED** to contract by this amendment are as follows:

    a) SECTION 07412 - METAL WALL PANELS
    b) SECTION 13110N - CATHODIC PROTECTION BY GALVANIC ANODES 09/00
    c) Issued with this amendment, as information for the bidders, is the 1July 2002 Geotechnical Report for the project site.

4. Specifications sections have been **REVISED** and **NOT REISSIED** are as indicated in the following: NONE.

BIDDER'S QUESTIONS AND GOVERNMENT REPLY

(Questions that may be of general interest of all bidders/Government and that are not readily answered by the proceeding changes will appear below. These questions may have been paraphrased or altered to represent several questions regarding the same subject and/or clarify and simplify the question(s). Questions and answers are issued to the Offerors/Bidders for information only.)

Q23: Reference Drawing A-502; Wall sections 1 & 2 on drawing A-502 show an ACM panel at the fascia and soffit. What does the abbreviation ACM stand for? We cannot locate a spec for the ACM panel, please provide one for bidding purposes. Note: This question and the Governments response appeared in amendment #2; the below answer supercedes the previous response issued by the Government.

A24: This means Aluminum Composite Material. Specification a) SECTION 07412 - METAL WALL PANELS which accompanies this amendment provides a complete description of this material.

Q30: Are there wood panels on the east and west side of rooms 155 & 156. Section 3/A-301 appears to depict wood panels and base or some other type of outline material.

A30: Clarification: Wood Veneer panels and Acoustic Fabric panels are to be installed on all four walls of Rooms 155 & 156 as illustrated on Drawing 2-A301 and noted on the Room Finish Schedule Sheet A-601."

Q31: Please provide details and information for the metal base in the main lobby, Room. 101.

A31: Metal base details are provided on A-611 and located on A-300 in Revision No.1 dated 9/11/03.

Q32: I would like to know if the purchase of furniture is included in your scope of work. In other words will you be buying the furniture?

A32: Furnishings, such as chairs, desks, systems furniture, and artwork are not included in the work under this contract.

Q33: Drawing T-401 cable notes #5 and #6 states to run 24 strand fiber and 900 pair copper to maintenance hole #8 however we can not seem to locate maintenance hole #8on drawing C-6. Would the comm. vault located below Grissom Road at the bottom right of the new building be maintenance hole #8? Please advise.

A33: No, the maintenance hole note on T-401 is referring to the communication source shown on C-6, located near the main parking lot, north west of the CFOF building. [Maintenance hole #8 is nomenclature used for proposed work in the Communications Support project}.

Q34: Who is responsible for terminators to existing fibers and copper cables in manholes? If terminations are under this contract, what type of termination is required? Please advise.

A34: The contractor is responsible for all communication terminations and/or connections, which shall be handled by splicing as specified in Section 16711A.

Q35: What are the percentage goals for the Subcontracting Plan? Are those goals mandatory?

A35: Of the TOTAL subcontracted dollars, 40% should go to Small Business entities. These figures will be negotiated with the low bidder prior to award.

Q36: What are the liquidated damages for non-compliance with the subcontracting plan?

A36: Liquidated damages for noncompliance is determined on a case-by-case basis, depending on the good faith effort to make the goals proposed and the reasons for noncompliance. In the event no effort is made on the part of the successful contractor, SBA has the authority to direct the Corps to "terminate" the contractor during construction, for noncompliance.

Q37: Reference is made to Drawing 2.02. This drawing a blow-up elevation of South wall between column lines 13 & 16 marked 17/A-509. The detail number is not correct. This detail does not exist. Please provide.

A37: The drawing A-509 (Revision No.1) is correct. All notes should be read on the drawing to identify Precast Quantity and size.

Q38: Reference is made to Drawing A4.01 and Section 2/5.01. Please provide soffit material identification at exterior overhang at the south wall.

A38: Exterior Soffit's shall be in accordance with Specification Section 09250-2.1.5 and 09250-3.2.4.

Q39: Reference is made to Drawing A4.02. Main lobby 101/201 details 5 & 2 on A-300 show curved metal ceiling system. A4.02 symbol calls for flat perforated metal ceiling system. Please identify correct ceiling system for this room. A4.02, Circulation Room 201 also shows curved metal ceiling system per detail 3/A6.12 however reflected ceiling drawing A4.02 calls for flat panel ceiling system. Please identify correct ceiling requirement for this room.

A39: Please refer to drawing A403 (Revision No.1) for additional information regarding custom ceiling design and lighting location.

Q40: Reference is made to Drawing 5/S2.04. Please provide detail at end of eave. There is no detail which Identifies the plate or angle at eave perimeter to anchor 2.x12 roof blocking or support the deck. Please provide.

A40: A202 – The drawing A-509 (Revision No.1) is correct. All notes should be read on the drawing to identify Precast Quantity and size.

Q41: Is it the A/E's intention to provide just a closure plate at the end of eave support angle to anchor blocking? Should there be a continuous perimeter steel angle or channel to support end of roof deck in mid span?

A41: Provide a 3/16" steel plate cut to fit into outrigger angle welded on the top and side of angle for the attachment of the blocking and support of the decking at all eave conditions.

Q42: Note #4 of drawing S-101 calls for 4" compacted crushed stone under slab but drawing A-501, A-502 calls for 6" gravel bed.

A42: Underslab gravel should be as described in the structural drawings and not in the architectural drawings.

Q43: There is no detail for Scored Concrete as shown on drawing C-4 and A00-l.

A43: Refer to revised drawing A-800 for additional information. The joints between the colored concrete shall be construction joints as defined in specification section 02770.

Q44: Please state the location of drawing #l1/A502 where it says 8" concrete. I did not see any cut on canopy that says 1/A502.

A44: This section is taken on drawing on "Building Elevation A-A" on drawing A-203.

Q45: Concrete strength as stated on note #2 of drawing S-001 does not match with that specified. Please clarify.

A45: Concrete compressive strength shall be as identified on the Contract Drawings Note #2 / S-001and not as identified in the specifications.

Q46: Drawing #3, A-512 calls for removable bollards, please state the quantity and location.

A46: Revised Drawing C-4 (Revision No.1) identifies the location and quantity of the removable bollards.

Q47: Section 08210-3 item #2.1.1.1 calls for flush wood doors. These two hardboard for premium grade Anigre are contradiction, please clarify whether it is hardboard or premium grade Anigre.

A47: Wood doors should be Premium Grade Anigre veneer on hardboard faces.

Q48: A question was address in Amendment #2 regarding hardware sets scheduled on sheet A-602 and Specification section 08710 for doors in demountable partitions. Your response was that frame, doors, and hardware will be supplied and installed by the demountable partition contractor. However, Drawing A-705 has a general note that demountable walls are not in contract; there is no specification section for same. Why are demountable doors still listed on hardware sets in 08710?

A48: Demountable door hardware is listed for information only when used with the furniture and demountable wall submittal.

Q49: We are requesting that the requirement for the steel fabricator and fabrication plant to be AISC certified per spec section 05120 1.6.A & B be waived. Limiting the structural steel to AISC plants and erectors further limits competitive bidding and thus the owner will not receive the best possible pricing. We request that the plant nor erector is required to be AISC certified but merely certify they will perform their work in accordance with AISC guidelines. In doing so the owner will receive the best possible pricing and have the quality control requirements. Please verify if this is acceptable?

A49: This requirement of the contract remains unchanged and this requirement will not be waived.

Q50: The answer to Bidder's Question 2a states: "This drawing has been revised and reissued with this amendment." However, the revised drawing C-3 does not address the bidders question. The Option area designations have not been changed.

A50: Revised drawing C-4 shows revisions in response to question 2A. The sliver of parking identified will be completely new and re-graded due to the alignment and connection to Vandenburg Ave. C-3 was reissued as part of Revision No.1; however, without any changes.

Q51: What is the aluminum finish to be? The specification indicates both color anodized and painted.

A51: The exterior aluminum frames are to be painted PT-11 and the interior aluminum frames are to be painted PT-2. Clarification – Drawing A-601 rooms 248 and 249, the door / window trim finish should read PT-2.

Q52: What is the finish for the all glass entrance fittings? The specifications indicate both anodized and #4 stainless steel.

A52: The finish for the all glass entrance fittings should be #4 Stainless Steel finish.

Q53: At CW7, do the single vertical lines in the upper area indicate a butt glazing situation with a back up mullion behind? Please clarify.

A53: The single vertical lines indicate butt glazing without a back up mullion.

Q54: The door specification indicates a 2" door, yet the details show a standard 1 ¾" thick narrow stile door. What type of door is the Architect looking for?

A54: Provide a 2" thick door as specified.

Q55: The hardware called out for door 125B (set 202) and door 213 (set 204) does not appear appropriate for an aluminum and glass door. Please clarify.

A55: Door 125B should have (2) sets of hardware set # 225 and door 213 should have hardware set #225.

Q56: Arch drawing. A-001 shows a total of six dumpster enclosures. On drawing A-001 only 3 of the 6 enclosures are highlighted with a detail drawing. Reference. One of the detail highlighted enclosures plus a non-highlighted enclosure is located in a parking lot which is not included in the contract (east side of building adjacent to White St.). Drawing C-4 only shows 5 dumpster enclosures. One of the highlighted enclosures shown on A-001 in the east parking lot is not shown on drawing. C-4.

Neither of the enclosures in the east parking lot is shown on the existing conditions drwg. C-2 which then indicates they're both new.

Please clarify exactly how many and what locations are the dumpster enclosures required in this project.

A56: There are 5 dumpster enclosures altogether in the boundaries shown on drwg. G-002. Any other dumpster enclosures are NIC.

Q57: Please provide specs, drawings and details for the concrete pavers.

A57: Refer to 02770A-2.1.5 and revised drawing A-800 for information (Revision No. 1).

Q58: Please provide a dimensioned detail drawing of the drop off circle. We need to have more detail of the decorative concrete AMC Logo.

A58: Bidders are advised to scale the drawing.

Q59: Reference is made to specification 0250. We need to know the soil information in order to determine the anticipated depth and the optimum configuration for the piles shown. We also need to know the safety factor required in the event that the safety factor has not already been included in the 20 kips for the compression and 8 kips in tension.
A59: A Geotechnical Report for this site has been issued with this amendment. The 20 kip load and 8 kip load are the working loads only.

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001		1	Lump Sum	_____	_____

CFOF, McGuire AFB, New Jersey
FFP
All work for the C-17 CFOF as described in the plans and specifications, including all plant and labor, complete and excluding Base Bid Items Nos. 0002, and 0003 below based on the 540 day performance period..
PURCHASE REQUEST NUMBER: W16ROE-3210-9068

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002		1	Lump Sum	_____	_____

CFOF, McGuire AFB, New Jersey
FFP
Site work, all work outside the building perimeter. Work under this bid item shall consist of all work associated with the removal of all site pavements and associated subgrades up to the existing building face, asphalt drives, sidewalks, etc., as well as demolition of existing building foundations and utility components. In addition, this bid item shall include all labor and material and related costs for new sitework.

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003		1	Lump Sum	$10,000.00	$10,000.00

CFOF McGuire AFB, New Jersey
FFP
All work for the Final Record Drawing Submission (See paragraphs 10 of Section 00800).

TOTAL BASE BID PRICE **$_____**

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004 OPTION		1	Lump Sum	_____	_____

OPTIONAL BID ITEM NUMBER 1
FFP
This bid item shall include all labor and material and related costs for outdoor shelters and associated paving, masonry wall, lighting and landscaping in Site Area "A".

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 2 FFP This bid item shall include all labor and material and related costs for site and utility demolition and new site utilities, parking lot, sidewalks, landscaping and lighting in Site Area "B".				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 3 FFP This bid item shall include all labor and material and related costs for site and utility demolition and new site utilities, parking lot, sidewalks, landscaping and lighting in Site Area "C".				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 4 FFP This bid item shall include all labor and material and related costs for site and utility demolition and new site utilities, parking lot, sidewalks, landscaping and lighting in Site Area "D".				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 5 FFP This bid item shall include all labor and material and related costs for site and utility demolition and new site utilities, parking lot, sidewalks, landscaping and lighting. NOTE: this work can not commence until the new facility is occupied and the owner has removed the existing building structures above grade in Site Area "E." Work may commence 20 calendar days following acceptance of the CFOF.				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0009		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 6 FFP This bid item shall include all labor and material and related costs for site and utility demolition and new site utilities, parking lot, sidewalks, landscaping and lighting in Site Area "F." Work may commence 20 calendar days following acceptance of the CFOF.				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0010		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 7 FFP This bid item shall include all labor and material and related costs for lightning protection.				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0011		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 8 FFP This bid item shall include all labor and material and related costs for mechanized material handling systems (MMHS) to provide a mobile aisle storage system.				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0012		1	Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 9 FFP Additional work for construction of a wood shadow-box type construction fence in lieu of a chain-link construction fence, and to paint the dumpsters, trash containers and temporary sanitation facilities, and contractor trailers, offices and storage buildings, the standard Base colors.				

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0013			Lump Sum	_____	_____
OPTION	OPTIONAL BID ITEM NUMBER 0010 FFP The addition of a Government Field Trailer inclusive of the internal office support equipment specified in Section 0800, paragraph 25, revised in this Amendment #2.				

TOTAL AMOUNT Options (Totlal of CLINS Numbered 0004 thru 0013) $ _____

TOTAL CONTRACT AMOUNT (BASE BID & CLINS 0004 thru 0013) $_____

ADDITIONAL BID INFO

THE GOVERNMENT DESIRES THAT THE PROJECT BE COMPLETED IN LESS THAN THE 540 DAYS INDICATED IN THE SOLICITATION. EACH BIDDER SHOULD PROVIDE, IN THE LINE ITEMS BELOW, THE VALUE OF THE ALTERNATE PERFORMANCE PERIOD.

ALTERNATE PERFORMANCE PERIODS FOR CONSIDERATION:

ALTE RNATE 1:

Difference in Price (plus or minus) for changing the performance period to 510 calendar days in lieu of the 540 calendar days specified in the solicitation, Section 0800, paragraph 1a.

Total Bid Amount for a 30 day Reduction in Performance Period $ _____

ALTERNATE 2:

Difference in Price (plus or minus) for changing the performance period to 480 calendar days in lieu of the 510 calendar days.

Total Bid Amount for an Additional 30 day Reduction in Performance Period $ _____

ALTERNATE 3:

Difference in Price (plus or minus) for changing the performance period to 450 calendar days in lieu of the 480 calendar days.

Total Bid Amount for an Additional 30 day Reduction in Performance Period $ _____

ALTERNATE 4:

Difference in Price (plus or minus) for changing the performance period to 420 calendar days in lieu of the 450 calendar days.

Total Bid Amount for an Additional 30 day Reduction in Performance Period $ _____

1. Basis for Award: The low bidder for purposes of award will be the conforming responsible bidder offering the lowest amount for the Base Bid and all Optional Bid items plus all the Alternate items that provides the best reduced performance period for the work within the funds determined by the Government to be available before bids are opened. Should the Government receive additional funds, we may award additional alternatives as long as the standing of the bidders does not change.

Example: The amount available is $100,000. Bidder A's base bid and four alternatives (in the order stated in the list of priorities in the Bid Schedule) are $85,000, $10,000, $8,000, $6,000 and $4,000. Bidder B's base bid and four alternatives are $80,000, $16,000, $9,000, $7,000 and $4,000. Bidder A is the low bidder

2. The minimum construction award will be the amount bid for the Base Bid Items (CLINS 0001 thru 0003).

3. Bidders are required to bid on the Base Bid, all Optional Bid Items and the four (4) Alternate Items or their bids will be rejected.

4. Bidders are reminded that they must bid on the issued plans and specifications as amended. Any deviations, conditions or attachments made by the bidder himself thereto may render the bid non-responsive and be cause for its rejection.

5. Optional Bid Items 1 thru 10 (CLINS 0004– 0013): Within 120 calendar days after award of the contract, the Government at its option, should funds be available, may direct the Contractor, by written order, to perform the work and/or services provided under any of the following options: Options1, 2, 3, 4, 5, 6, 7, 8, 9 and /or 10. If Options 1, 2, 3, 4, 6, 7, 8, 9 and/or 10 are awarded, no additional time will be provided beyond that established for the base bid work.

6. For Option #5, the contract completion date will be extended a total of 40 calendar days. Separate Liquidated Damages will also apply if this CLIN is not completed on schedule in the amount of $266/day. NOTE: This work cannot commence until the new facility is occupied and the owner has removed the existing building structures above grade in Site Area "E." Work may commence 20 calendar days following acceptance of the CFOF.

7. For Option #6, Separate Liquidated Damages will also apply if this CLIN is not completed on schedule in the amount of $266/day. NOTE:" Work may commence 20 calendar days following acceptance of the CFOF.

8. CLIN Item No. 0003 is a pre-priced, firm fixed line item and price shown may not be changed.

9. Once award is made on either the Base Bid performance period of 540 days or one of the Alternate schedules the selected performance period becomes the new contractual performance period. Liquidated damages will be assessed in the amount of $6,736/day for each day of delay on this accepted period.

10. Award may require approval of the Air Force Headquarters to expedite contract completion, e.g. to award the alternative item. If approval is not granted, award will be made to the bidder offering the lowest bid price for base bid and optional bid items.

(End of Summary of Changes)

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CONSOLIDATED FLIGHT OPERATIONS FACILITY

MCGUIRE AIR FORCE BASE

VOLUME 1

SECTION
NUMBER TITLE

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NUMBER TITLE

SECTION 07412

METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Metal-faced composite wall panels, including column covers.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal wall panels.
2. Division 7 Section "Sheet Metal Flashing and Trim" for copings, flashings and other sheet metal work not part of metal wall panel assemblies.
3. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight system.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft..

C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..

D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure as indicated on Drawings.

E. Thermal Movements for Metal-Faced Composite Wall Panels: Provide composite wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:

1. Ambient Temperature Range: Minus 20 to plus 180 deg F.

F. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 236 or ASTM C 518.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

Product Data; G, AE

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

a. Flashing and trim.

2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Shop Drawings

Detail Drawings; G, AE

Detail drawings as specified.

C. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. Stud framing.
3. Wall-mounted items including windows, and lighting fixtures.

Coordination Drawings; G, AE

Detail drawings as specified.

D. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

Samples G, AE

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- long Samples for each type of accessory.
4. Exposed Gaskets: 12 inches long.
5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of metal wall panels adjacent to joint sealants.

Samples: G, AE

F. Qualification Data: For professional engineer and testing agency.

Qualification Data: G

G. Material Certificates: For vapor retarders, signed by manufacturers.

Certificates: G

H. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

Test Reports: G

I. Field quality-control test reports.

Test Reports: G

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Wall Panels: Include reports for air infiltration, water penetration, fire-test-response characteristics, and structural performance.

Test Reports: G

K. Research/Evaluation Reports: For metal-faced composite wall panels.

Reports: G

L. Maintenance Data: For metal wall panels to include in maintenance manuals.

Maintenance Data: G

M. Warranties: Special warranties specified in this Section.

Warranties: G

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Installer Qualifications for Composite Wall Panels: Fabricator of metal-faced composite wall panels.

1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility for Composite Wall Panels: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Fabricator Qualifications: Certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer's wall panel system.

D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

E. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Contracting Officer, except with Contracting Officer's approval. If modifications are proposed, submit comprehensive explanatory data to Contracting Officer for review.

G. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under environmental conditions replicating those that will exist during installation.

2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

H. Surface-Burning Characteristics: Provide insulated metal wall panels having insulation-core materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less, unless otherwise indicated.
2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

I. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of typical corner wall panel; approximately 48 inches square by full thickness, including insulation, supports, attachments, and accessories.

a. Include four-way joint for metal-faced composite wall panels.

2. Approval of mockups is for other material and construction qualities specifically approved by Contracting Officer in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Contracting Officer in writing.

J. Preliminary Siding Conference: Before starting wall framing construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section

"Project Management and Coordination." Review methods and procedures related to wall framing construction and metal wall panels including, but not limited to, the following:

1. Meet with Owner, Contracting Officer, insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, composite metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of windows.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to composite metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect composite metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. Coordinate metal wall panel assemblies with flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Weathertight Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Basis-of-Design Products: The design for each metal wall panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled metal-faced composite wall panels, including column covers, fabricated from two metal facings bonded, using no glues or adhesives, to solid extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

1. Available Products:

a. Alusuisse Composites, Inc.; Alucobond.
b. Reynolds Metals Company; Reynobond PE.

B. Aluminum-Faced Composite Wall Panels ACM: Formed with 0.020-inch-thick, painted aluminum sheet facings.

1. Panel Thickness: 0.236 inch.
2. Core: Standard.
3. Exterior Finish: Fluoropolymer.

a. Color: PT-11.

C. Attachment System Components: Formed from material compatible with panel facing.

1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.

D. Flashing and Trim: Same material, finish, and color as facings of adjacent composite panels, unless otherwise indicated.

2.3 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Composite Wall Panels: Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal-Faced Composite Wall Panels: Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.

1. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
3. Dimensional Tolerances:

a. Length: Plus 0.375 inch.
b. Width: Plus 0.188 inch.
c. Thickness: Plus or minus 0.008 inch.
d. Panel Bow: 0.8 percent maximum of panel length or width.
e. Squareness: 0.2 inch maximum.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is

within flatness tolerances required by metal wall panel manufacturer.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Miscellaneous Framing: Install base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

B. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.

1. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
2. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

3. Do not apply sealants to joints, unless otherwise indicated on Drawings.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water-Spray Test: After completing the installation of 75-foot-by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.

D. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07412

SECTION 13110N

CATHODIC PROTECTION BY GALVANIC ANODES
09/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1	(1986, R 1997) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts

ASME INTERNATIONAL (ASME)

ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.25	(1997) Buttwelding Ends
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B18.2.1	(1996) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 194/A 194M	(1998; Rev. A) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B 418	(1995; Rev. A) Cast and Wrought Galvanic Zinc Anodes
ASTM B 843	(1993; R 1998) Magnesium Alloy Anodes for Cathodic Protection
ASTM C 94	(1998; Rev. C) Ready-Mixed Concrete
ASTM D 1248	(1998) Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D 2028	(1997) Cutback Asphalt (Rapid-Curing Type)
ASTM D 3381	(1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM F 1182	(1990; R 1996) Anodes, Sacrificial Zinc Alloy

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-I-1361	(Rev. C) Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors and Transformers

NACE INTERNATIONAL (NACE)

NACE RP0169	(1996) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

MILITARY STANDARDS

UFC-3-570-06	Operation and Maintenance Manual, Cathodic Protection
AFH32-1290(I)	Cathodic Protection Field Testing
AFI32-1054	Corrosion Control

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(1990) Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997; R 1999) Rigid Metal Conduit
UL 44	(1999) Thermostat-Insulated Wires and Cables
UL 83	(1998) Thermoplastic-Insulated Wires and Cables
UL 486A	(1997; R 1998) Wire Connectors and Soldering Lugs for Use With Copper Conductors
UL 510	(1994; R 1998) Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; R 1998) Metallic Outlet Boxes
UL 514B	(1997; R 1998) Fittings for Cable and Conduit

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Insulating flange sets

Anode junction boxes, bonding boxes and test stations

Joint bonds

Plans and sections indicating location of anodes, junction boxes, and connections to piping

SD-03 Product Data

Anodes; G

Anode junction boxes, bonding boxes, and test stations

Insulating flange sets

Dielectric unions

Wires

Cable and wire

Casings, insulation, and seals

Shunt resistors

Permanent reference electrodes; G

SD-07 Certificates

Qualifications of Corrosion Engineer; G

SD-10 Operation and Maintenance Data

Cathodic Protection System, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data."

SD-11, Closeout Submittals

Initial Cathodic Protection System Field Test Report; G

One Year Warranty Period Cathodic Protection System Field Test Report; G

Final Cathodic Protection System Field Test Report; G

1.3 SERVICES OF CORROSION ENGINEER

The Contractor shall obtain the services of a corrosion engineer to design, supervise, inspect and test the installation of the cathodic protection system(s). Corrosion Engineer refers to a registered professional engineer with certification of licensing that includes education and experience in cathodic protection of buried or submerged metal structures, or a person accredited or certified by the National Association of Corrosion Engineers at the level of Corrosion Specialist or Cathodic Protection Specialist. Such a person shall have not less than five years experience in the cathodic protection of underground piping or submerged structures. The contractor shall submit evidence of the qualifications of corrosion engineer to the Contracting Officer for review and approval.

1.4 SCOPE OF WORK - CATHODIC PROTECTION

The scope of work of the cathodic protection shall be limited to all new metallic underground piping to be installed.

PART 2 PRODUCTS

2.1 ANODES

2.1.1 Magnesium

ASTM B 843 Chemical composition as follows:

Aluminum	0.01 percent maximum
Manganese	0.5-1.3 percent
Copper	0.02 percent maximum
Nickel	0.001 percent maximum
Iron	0.03 percent maximum

Other Impurities	0.05 percent each, 0.3 percent maximum total
Magnesium	Remainder

a. Bare anode weight: 17 pounds not including core.

2.1.2 Cast Zinc

ASTM B 418, Type II. Bare anode weight: 30 pounds not including core.

2.1.3 Anode Wires and Core

2.1.3.1 Anode Lead Wires

UL 83, Type THWN/THHN ASTM D 1248, Type HMWPE (High Molecular Weight Polyethlene), solid copper conductors not less than 10 AWG of sufficient length to extend to the accompanying junction box without splicing. Anode lead wire shall be factory installed. Dielectric material shall extend past the connection and cover the lead wire insulation by not less than 1/2 inch. [Cover the connection with heat shrinkable tubing.]

2.1.4.2 Anode Core

Iron, galvanized, steel rod pipe.

2.1.5 Anode Backfill

Chemical composition as follows:

Hydrated gypsum	-	75 percent
Bentonite clay	-	20 percent
Sodium sulfate	-	5 percent

Provide granular backfill with 100 percent passing through a 100 mesh screen. Provide prepackaged anode in a cloth bag containing the anode and backfill. Center the anode in the firmly packed backfill using spacers.

2.2 ANODE JUNCTION BOXES, BONDING BOXES, AND TEST STATIONS

2.2.1 Flush Mounted Type

NEMA ICS 6. Metallic or non-metallic with terminal board, Type NM-7 8 terminal posts. A non-metallic enclosure shall be molded of glass filled polycarbonate and urethane coated or ABS plastic. The unit shall be of standard design, manufactured for use as a cathodic protection test station, complete with cover, terminal board, shunts, and brass or Type 304 stainless steel hardware. The terminal board shall be removable for easy access to wires. Provide traffic valve box capable of withstanding H-20 traffic loads. The cover shall have a cast in legend "CP TEST."

2.2.2 Terminal Boards

Provide terminal boards for anode junction boxes, bonding boxes, and test stations made of phenolic plastic 1/8 inch thick. Insulated terminal boards shall have the required number of terminals (one terminal required for each conductor). Install solderless copper lugs and copper buss bars, shunts, and variable resistors on the terminal board as indicated. Test station terminal connections shall be permanently tagged to identify each

termination of conductors (e.g. identify the conductors connected to the protected structure, anodes, and reference electrodes). Conductors shall be permanently identified by means of plastic or metal tags, or plastic sleeves to indicate termination. Each conductor shall be color coded as follows:

Anode lead wire - black
Structure lead wire - white
Reference electrode lead wire - red

2.2.3 Pavement Insert

Pavement insert shall be a non-metallic flush type test station without terminal board, and shall allow a copper-copper sulfate reference electrode to contact the electrolyte beneath the pavement surface. Provide traffic valve box capable of withstanding H-20 traffic loads.

2.3 CABLE AND WIRE OTHER THAN ANODE LEAD WIRES

UL 83, Type THWN/THHN ASTM D 1248, Type HMWPE (High Molecular Weight Polyethylene), solid copper conductor, color coded and sized (based on AWG). Copper wires shall conform to ASTM B 3 and ASTM B 8. Lead wires terminating at a junction box or test station shall have a cable identification tag. Do not use bare copper wire for joint continuity bonds. Refer to paragraph 2.1.4 for anode lead wires.

2.4 CABLE AND WIRE IDENTIFICATION TAGS

Laminated plastic material with black letters on a yellow background. Print letters and numbers a minimum of 3/16 inch in size. Provide identifier legend for approval.

2.5 WIRE CONNECTORS

UL 486A. Solderless copper lugs

2.6 UNDERGROUND SPLICES

Provide splices with a compression connector on the conductors, and insulation and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

a. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material applied by a gravity poured method or pressure injected method. Provide component materials of the resin insulation in a packaged form ready for convenient mixing without removing from the package.

(1) Gravity poured method shall employ materials and equipment contained in and approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold.

2.7 CONDUIT

Install conduit in accordance with Division 16, Section 16275A Electrical Distribution System, Underground.

2.7.1 Buried Cable Warning and Identification Tape

Polyethylene tape, manufactured for warning and identification of buried cable and conduit. Tape shall be 3 inches wide, yellow in color and read "Caution Buried Cable Below" or similar. Color and lettering shall be permanent and unaffected by moisture or other substances in backfill materials.

2.8 INSULATING TAPE

UL 510.

2.9 INSULATING FLANGE SETS

Provide full-faced gaskets, insulating sleeves and washers, and steel washers. Provide insulating flange sets rated for operation at the rated pressure and temperature.

2.9.1 Gaskets

ASME B16.21. Neoprene faced phenolic. Provide as per temperature and pressure of specified piping.

2.9.2 Insulating Washers and Sleeves

Two sets 1/8 inch laminated phenolic. Insulating washers shall fit within the bolt facing on the flange over the outside of the fabric reinforced phenolic sleeve. Provice as per temperature and pressure of specified piping.

2.9.3 Washers

Steel, cadmium plated, to fit within the bolt facing on the flange.

2.10 STEEL FLANGES AND BOLTING

2.10.1 Steel Flanges

ASME B16.5, 300 lb.

2.10.2 Bolting

ASTM A 307, Grade B for bolts; ASTM A 194/A 194M, Grade 2 for nuts. Dimensions: ASME B18.2.1 for bolts, ASME B18.2.2 for nuts. Threads: ASME B1.1, Class 2A fit for bolts, Class 2B fit for nuts. Bolts shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at the roof of threads.

2.11 EXOTHERMIC WELD KITS

Exothermic weld kits specifically designed by the manufacturer for welding the types of materials and shapes provided. All welds shall be thermite type.

2.12 ELECTRICALLY INSULATING COATINGS

Conformable water tight sealant having dielectric strength not less than 15 kV for a 1/8 inch thick layer.

2.13 CASING INSULATORS AND SEALS

Casing insulators shall have a minimum 12 inch band width, constructed of heat fused plastic coated steel and multi-segmented to attach firmly around the pipe. Casing end seals shall be S-shaped rubber seals with stainless steel straps.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70, ANSI C2.

3.1.1 Anodes and Lead Wires

Provide each anode and lead wires as follows:

a. Excavate hole to a minimum 3 inches larger than the packaged anode diameter.

b. Excavate lead wire trench to 24 inches deep.

c. Do not lift or support anode by the lead wire. Where applicable, remove manufacturer's plastic wrap/bag from the anode. Exercise care to preclude damaging the cloth bag and the lead wire insulation.

d. Center the packaged anode in the hole with native soil in layers not exceeding 6 inches. Hand tamp each layer to remove voids taking care not to strike the anode lead wire. When the backfill is 6 inches above the top of the anode, pour not less than ten gallons of water into the hole to saturate the anode backfill and surrounding soil. Anodes shall not be backfilled prior to inspection and approval by the Contracting Officer.

e. Cover the lead wire trench bottom with a 3 inch layer of sand or stone free earth. Center wire on the backfill layer, do not stretch or kink the conductor. Place backfill over wire in layers not exceeding six inches deep, compact each layer thoroughly. Do not place tree roots, wood scrap, vegetable matter and refuse in backfill. Place cable warning tape within 12 inches of finished grade, above cable and conduit.

f. Connect anode lead wire(s) directly to the protected structure(s) by use of exothermic weld kit(s). Clean the structure surface by scraping, filing or wire brushing to produce a clean, bright surface. Weld connections using exothermic kit(s) in accordance with the kit manufacturer's instructions. Check and verify adherence of the bond to the substrate for mechanical integrity by striking the weld with a 2 pound hammer. Cover connections with an electrically insulating coating which is compatible with the existing coating on the structure. Allow sufficient slack in the lead wire to compensate for movement during backfilling operation.

g. Connect structure leads to structure by use of exothermic weld kit(s). Clean the structure surface by scraping, filing or wire brushing to produce a clean, bright surface. Weld connections using exothermic kit(s) in accordance with the kit manufacturer's instructions. Conform to the safety precautions of paragraph 3.1.2 when welding around fuel facilities. Check and verify adherence of the bond to the substrate for mechanical integrity by striking the weld with a 2 pound hammer. Cover connections with an electrically insulating coating which is compatible with the existing coating on the structure. Connect structure lead wires to the test station terminal board(s).

3.1.2 Safety Precautions For Welding Around Fuel Facilities

Contractor shall take proper safety precautions prior to and during welding to live fuel pipelines. Contractor shall notify the activity Fuel Office via the Contracting Officer a minimum of three days before performing exothermic welding to live fuel lines. Exothermic welding shall be conducted with fuel flowing through the pipeline to eliminate vapor spaces within the pipe and to dissipate the heat on the pipe. Exothermic weld charges for connections to fuel lines shall be limited to a maximum 15 gram charge to prevent burning through the pipe wall. Exothermic weld connections shall be spaced a minimum of 6 inches apart. In the event of an unsucceessful weld, the new weld location shall be located a minimum of 6 inches from the unsuccessful weld and any other existing welds. Contractor shall obtain the services of a certified Marine Chemist or Certified Industrial Hygienist to monitor the construction site during exothermic welding work and certify that the area is free of flammable vapors and otherwise safe for work. Results of this consultation shall be included in the Contractor's Daily Report.

3.1.3 Anode Junction Boxes

Provide junction boxes and mark each of the wires terminating in each box.

3.1.4 Bonding Boxes

Provide structure bonding boxes in locations where the protected structure crosses or comes into close proximity to other metal structures that are unprotected or protected by its own electrically isolated cathodic protection system(s).

3.1.5 Test Stations

Provide test stations as follows:

a. At 1000 foot intervals.

b. At all insulating joints.

c. At both ends of casings.

d. Where the pipe crosses any other metal pipes.

e. Where the pipe connects to an existing piping system.

f. Where the pipe connects to a dissimilar metal pipe.

Do not fill the bottom of the test station with concrete unless otherwise specified. Do not place rubbish, scrap or other debris into the test station.

3.1.6 Insulating Flange Sets

Cut piping and install flanges without stressing piping. Weld flanges according to ASME B16.25. Cover flanges with sealing and dielectric compound.

3.1.7 Joint Bonds

Provide joint bonds on metallic pipe to and across buried flexible couplings, mechanical joints, flanged joints except at places where insulating joints are specified and joints not welded or threaded to provide electrical continuity. Connect bond wire(s) to the structure(s) by use of exothermic weld kit(s). Clean the structure surface by scraping, filing or wire brushing to produce a clean, bright surface. [Weld connections using exothermic kits in accordance with the kit manufacturer's instructions.] Check and verify adherence of the bond to the substrate for mechanical integrity by striking the weld with a 2 pound hammer. Cover connections with an electrically insulating coating which is compatible with the existing coating on the structure.

3.1.8 Casings, Insulation, and Seals

Where the pipeline is installed in a casing under a roadway or railway, insulate the pipeline from the casing, and seal the annular space against intrusion of water.

3.1.9 Concrete

Concrete shall be 3000 psi minimum ultimate 28-day compressive strength with one inch minimum aggregate conforming to ASTM C 94.

3.1.10 Reconditioning of Surfaces

3.1.10.1 Restoration of Sod

Restore unpaved surfaces disturbed during the installation of anodes and wires to their original elevation and condition. Preserve sod and topsoil carefully and replace after the backfilling is completed. Where the surface is disturbed in a newly seeded area, re-seed the area with the same quality and formula of seed as that used in the original seeding.

3.1.10.2 Restoration of Pavement

Repair pavement, sidewalks, curbs, and gutters where existing surfaces are removed or disturbed for construction. Saw cut pavement edges. Graded aggregate base course shall have a maximum aggregate size of 1 1/2 inches. Match existing pavement, sidewalk, curb, and gutter thicknesses.

3.2 FIELD QUALITY CONTROL

Field tests shall be witnessed by the Contracting Officer or his designated representative. Advise the Contracting Officer 5 days prior to performing

each field test. Quality control for the cathodic protection system shall consist of the following:

a. Initial field testing by the contractor upon construction

b. Government Field Testing after Contractor initial field test report submission.

c. Warranty period field testing by the Contractor.

d. Final field testing by the contractor after one year of service.

3.2.1 Testing

3.2.1.1 Non-Destructive Testing of Anodes

Contractor shall perform the tests in the presence of the Contracting Officer. One anode of each type shall be chosen at random for non-destructive testing and shall be submerged in a container of fresh water for about 30 minutes. Contractor shall then measure the anode-to-water potential difference between a calibrated copper-copper sulfate reference electrode. Potential differences should generally be within the following ranges:

High potential Magnesium	-1.65 to -1.75 Volts
Standard Magnesium	-1.4 to -1.5 Volts
Zinc	-1.0 to -1.15 Volts

3.2.1.2 Destructive Testing of Anodes

Contractor shall perform the tests in the presence of the Contracting Officer. Contractor shall include the cost of an additional anode of each different type with the longest lead wire for the destructive test in his bid. One completed [prepackaged] anode of each type with lead wires shall be chosen at random for destructive testing and shall be submitted to a static pull test. Anode wire connections shall have sufficient strength to withstand a minimum tensile load of 300 pounds. Failure of the test anode to conform to this specification can be cause for rejecting all anodes from the same lot as the test anode. The contractor shall mark all rejected anodes on the ends with a 6" high "X" using yellow spray paint. Failed anodes shall be removed from the job site by the end of the day. The contractor shall replace any rejected anodes at his expense. The destructive testing provision shall also apply to replacement anodes as well.

3.2.1.3 Initial Cathodic Protection System Field Testing

Systems shall be tested and inspected by the Contractor's corrosion engineer in the presence of the Contracting Officer's corrosion protection engineer or an approved representative. Record test data, including date, time, and locations of testing and submit report to the Contracting Officer. Contractor shall correct and retest, at his expense, deficiencies in the materials and installation observed by these tests and inspections. Testing shall include the following measurements.

a. Base potential tests: At least one week after backfilling of the pipe and installation of the anodes, but before connection of

anodes to the structure, measure base (native) structure-to-electrolyte potentials of the pipe and casings. Perform measurements at anode junction boxes, test stations and other locations suitable for test purposes (such as service risers or valves), at intervals not exceeding 100 feet. The locations of these measurements shall be identical to the locations specified for potential measurements with anodes connected. Use the same measuring equipment that is specified for measuring protected potential measurements.

b. Insulation joint testing: Perform insulation testing at each insulating joint or fitting prior to burying the joint or fitting before and after the connection of anodes to the pipe at anode junction box or test station. Before connection, test using an insulation checker. After connection, test by measuring the potential shift on both sides of the insulating joint. These tests shall demonstrate that no metallic contact or short circuit exists between the two insulated sections of the pipe. Report and repair defective insulating flanges at the Contractor's expense.

c. Electrical continuity testing: Perform electrical continuity testing for joint bonded pipe prior to backfilling of the pipe. Circulate current through the pipe and compare the measured resistance to the theoretical resistance of the pipe and bond cables. The resistance measured shall not exceed 150 percent of the theoretical resistance.

d. Pipe casing testing: Before final acceptance of the installation, test the electrical insulation of the carrier pipe from casings and correct any short circuits.

e. Anode-to-soil potential and anode output testing: Measure anode-to-soil potential of each anode with the anode disconnected. After connecting the anodes to the pipe, measure current output of each anode.

f. Protected potential measurement tests: With the entire galvanic protection system put into operation for at least one week, measure potentials along the pipeline and at all casings using a portable copper-copper sulfate reference electrodes and a voltmeter having an input impedance of not less than 10 megohm. The locations of these measurements shall be identical to the locations used for the base potential measurements.

g. Interference testing: Perform interference testing with respect to any crossing and nearby foreign pipes in cooperation with the owner of the foreign pipes. The testing shall verify that the cathodic protection system does not have a deleterious effect on the foreign pipelines, and vice versa. Prepare a full report of the tests giving all details including remedial actions taken or recommendations to correct noted interference problems.

3.2.1.4 Initial Cathodic Protection System Field Test Report

The contractor shall submit a field test report of the cathodic protection system. All structure-to-electrolyte measurements, including initial potentials and anode outputs, shall be recorded on applicable forms.

Identification of test locations, test station and anode test stations shall coordinate with the as-built drawings and be provided on system drawings included in the report. The contractor shall locate, correct, and report to the Contracting Officer any short circuits encountered during the checkout of the installed cathodic protection system.

3.2.1.5 Government Field Testing

The government corrosion engineer shall review the Contractor's initial field testing report. Approximately four weeks after receipt of the Contractor's initial test report, the system will be tested and inspected in the Contractor's presence by the government corrosion engineer. The Contractor shall correct, at his expense, materials and installations observed by these tests and inspections to not be in conformance with the plans and specifications. The Contractor shall pay for all retesting done by the government engineer made necessary by the correction of deficiencies.

3.2.1.6 One Year Warranty Period Testing

The Contractor shall inspect, test, and adjust the cathodic protection system semi-annually for one year, 2 interim inspections total, to ensure its continued conformance with the criteria outlined below. The performance period for these tests shall commence upon the completion of all cathodic protection work, including changes required to correct deficiencies identified during initial testing, and preliminary acceptance of the cathodic protection system by the Contracting Officer. Copies of the One Year Warranty Period Cathodic Protection System Field Test Report, including field data, and certified by the Contractor's corrosion engineer shall be submitted to the Contracting Officer, the activity, and the geographic Engineering Field Division corrosion engineer.

3.2.1.6 Final Field Testing

Conduct final field testing of the cathodic protection system utilizing the same procedures specified under, "Initial Field Testing of the Galvanic Cathodic Protection Systems". The Contractor shall inspect, test, and adjust the cathodic protection system after one year of operation to ensure its continued conformance with the criteria outlined below. The performance period for these tests shall commence upon preliminary acceptance for the cathodic protection system by the Contracting Officer. Copies of the Final Cathodic Protection System Field Test Report, certified by the Contractor's corrosion engineer shall be submitted to the Contracting Officer and the geographic Engineering Field Division corrosion engineer protection program manager, LANTNAVFACENGCOM Code 1614 for approval, and as an attachment to the operation and maintenance manual in accordance with Section 01781, "Operation and Maintenance Data".Text

3.2.2 Criteria for Cathodic Protection

Conduct in accordance with NACE RP0169. Criteria for determining the adequacy of protection shall be selected by the corrosion engineer as applicable:

a. A negative voltage of at least 0.85 volt (850 millivolts) as measured between the structure surface and a saturated copper-copper sulfate reference electrode contacting the earth. Determination of this voltage is to be made with the protective

current applied to the pipeline for a minimum of 24 hours. Voltage drops must be considered for valid interpretation of this voltage measurement. The method of voltage drop consideration shall be identified by the Contractor's corrosion engineer and approved by the Government corrosion engineer.

b. A negative polarized potential of at least 0.85 volt (850 millivolts) as measured between the structure surface and a saturated copper-copper sulfate reference electrode contacting the earth. Determination of this voltage is to be made after the protective current has been applied to the pipeline for a minimum of 24 hours.

c. A minimum polarization voltage shift of 100 mV measured between the structure surface and a saturated copper-copper sulfate reference electrode contacting the earth electrolyte. This voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. At the instant the protective current is interrupted ("instant off"), an immediate voltage shift will occur. The voltage reading just after the immediate shift shall be used as the base reading from which to measure the polarization decay. The polarization decay shall be the difference between the base reading and a voltage measurement made 24 hours after the interruption of protective current.

3.3 DEMONSTRATION

3.3.1 Instructing Government Personnel

During the warranty testing and at a time designated by the Contracting Officer, make available the services of a technician regularly employed or authorized by the manufacturer of the Cathodic Protection System for instructing Government personnel in the proper operation, maintenance, safety, and emergency procedures of the Cathodic Protection System. The period of instruction shall be not less than one 8-hour working day. Conduct the training at the jobsite or at another location mutually satisfactory to the Government and the Contractor. The field instructions shall cover all of the items contained in the operation and maintenance manual.

SUBMITTAL REGISTER - B

CONTRACT NO.

TITLE AND LOCATION FY03 CFOF, MCGuire AFB, NJ

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION OR CAT/E	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		02450	**Power Installed Helical Screw**														
			Foundations														
			General														
			Product Data														
			Shop Drawings														
			QA/Control Submittals														
			Closeout Submittals														
		05721	**Ornamental Railings**														
			Product Data	1.5	G, AE												
			Shop Drawings		G, AE												
			Samples for Selection		G, AE												
			Samples for Verification		G, AE												
			Qualification Data		G, AE												
			Product Test Reports		G, AE												
		06402	**Product Data**														
			Product Data	1.4	G, AE												
			Shop Drawings		G, AE												
			Samples for Initial Selection		G, AE												
			Samples for Verification		G, AE												
			Product Certificates		G												
			Qualification Data		G												
		07412	**Metal Wall Panels**														
			Product Data	1.5	G, AE												

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			Shop Drawings		G, AE												
			Coordination Drawings		G, AE												
			Samples for Initial Selection		G, AE												
			Samples for Verification		G, AE												
			Qualification Data		G												
			Material Certificates		G												
			Compatibility and Adhesion Test		G												
			Reports														
			Field Quality Control Test Reports		G												
			Product Test Reports		G												
			Research/Evaluation Reports		G												
			Maintenance Data		G												
			Warranties		G												
		08411	**Aluminum Framed Entrances**														
			and Storefronts														
			Product Data	1.4	G, AE												
			Shop Drawings		G, AE												
			Samples for Initial Selection		G, AE												
			Samples for Verification		G, AE												
			Fabrication Sample		G, AE												
			Welding Certificates		G												
			Qualification Data		G												
			Product Test Reports		G												
			Field Quality Control		G												

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			Test and Inspection Reports		G												
			Maintenance Data		G												
			Warranties		G												
		08450	**All Glass Entrances and Storefronts**														
			Product Data	1.4	G												
			Shop Drawings		G												
			Samples for Verification		G												
			Qualification Data		G												
		08950	**Insulated Translucent Fiberglass**														
			Sandwich Panel Canopy System														
			Product Data	1.3	G												
			Samples		G												
			Test Reports		G												
			Submissions of Quality Control		G												
			Monitoring (Proof)														
			Complete Energy and Structural		G												
			Calculations														
		09638	**Stone Paving and Flooring**														
			Product Data	1.4	G, AE												
			Shop Drawings		G, AE												
			Grout Samples for Initial Selection		G, AE												
			Samples for Verification		G, AE												
			Qualification Data		G												
			Maintenance Data		G												

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					GOVT WR	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
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		09967	**Intumescent Paints**														
			Product Data	1.3	G												
			Samples for Initial Selection		G												
			Samples for Verification		G, AE												
			Qualification Data		G												
			Material Test Reports		G												
			Material Certificates		G												
		10125	**Display Cases**														
			Product Data	1.4	G, AE												
			Shop Drawings		G, AE												
			Samples for Initial Selection		G												
			Samples for Verification		G												
			Maintenance Data		G												
		10520	**Fire Protection Specialties**														
			Product Data	1.3	G, AE												
			Samples for Verification		G												
			Maintenance Data		G												
		12484	**Floor Mats and Frames**														
			Product Data	1.3	G, AE												
			Shop Drawings		G, AE												
			Samples for Initial Selection		G, AE												
			Samples for Verification		G, AE												
			Maintenance Data		G												
		13110N	**Cathodic Protection By**														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(I)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
			Galvanic Anodes	1.2													
		SD-02	Shop Drawings														
		SD-03	Product Data		G												
		SD-07	Certificates		G												
		SD-10	Operation and Maintenance Data		G												
		SD-11	Closeout Submittals		G												
		15055	**Motors**														
			Qualification Data	1.4	G												
			Source Quality Control		G												
			Test Reports		G												
			Field Quality Control		G												
			Test Reports		G												
		15075	**Mechanical Identification**														
			Product Data	1.3	G												
			Samples		G												
			Valve Numbering Scheme		G												
			Valve Schedules		G												
		15120	**Pipe Expansion Fittings and Loops**														
			Product Data	1.4	G												
			Shop Drawings		G												
			Welding Certificates		G												
			Operation and Maintenance Data		G												
		15189	**HVAC Water Treatment**														
			Product Data	1.5	G												

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			Shop Drawings		G												
			Water Analysis		G												
			Field Test Reports		G												
			Maintenance Data		G												
		15628	**Reciprocating/Scroll Water Chillers**														
			Product Data	1.3													
			Shop Drawings														
			Wiring Diagrams														
			Coordination Drawings														
			Certificates														
			Source Quality Control														
			Test Reports														
			Startup Service Reports														
			Operation and Maintenance Data														
		15725	**Modular Indoor Handling Units**														
			Product Data	1.3													
			Shop Drawings														
			Coordination Drawings														
			Maintenance Data														
		15755	**Electric Heating Cables**														
			Product Data														
			Shop Drawings														
			Field Test Reports														
			Maintenance Data														

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		15815	**Metal Ducts**														
			Shop Drawings	1.4													
			Coordination Drawings														
			Welding Certificates														
			Field Quality Control														
			Test Reports														

REPORT OF

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS MC GUIRE AIR FORCE BASE C-17 SQUADRON OPERATIONS / AIRCRAFT MAINTENANCE UNIT C-17 LIFE SUPPORT / SURVIVAL EQUIPMENT WRIGHTSTOWN, NEW JERSEY

ECS PROJECT NO. 7289

For

MR. ROBERT SMEDLEY
DMJMH+N
1525 WILSON BOULEVARD
SUITE 1100
ARLINGTON, VIRGINIA 22209-2412

JULY 1, 2002

REPORT

PROJECT

Subsurface Exploration
and Geotechnical Engineering Analysis
Mc Guire Air Force Base
C-17 Squadron Operations / Aircraft Maintenance unit
C-17 Life Support / Survival Equipment Shop

CLIENT

Mr. Robert Smedley
DMJMH+N
1525 Wilson Boulevard
Suite 1100
Arlington, Virginia 22209-2412

SUBMITTED BY

Engineering Consulting Services, Ltd.
2119-D North Hamilton Street
Richmond, Virginia 23230

ECS PROJECT NO. 7289

DATE July 1, 2002

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July 1, 2002

Mr. Robert Smedley
DMJMH+N
1525 Wilson Boulevard
Suite 1100
Arlington, Virginia 22209-2412

ECS Project No. 7289

Reference: Report of Subsurface Exploration and Geotechnical Engineering Analysis
Mc Guire Air Force Base
C-17 Squadron Operations / Aircraft Maintenance unit
C-17 Life Support / Survival Equipment Shop
Wrightsville, New Jersey

Dear Mr. Smedley:

Engineering Consulting Services, Ltd. is pleased to provide you with this report of subsurface exploration and geotechnical engineering analysis for the proposed support buildings located within the Mc Guire Air Force Base facility located Wrightsville, New Jersey. Submitted herein are the results of our soil test borings, laboratory analyses, and recommendations for geotechnical related design aspects for the proposed project.

We have enjoyed being of service to DMJMH+N during the design phase of this project. If you should have any questions regarding the information and recommendations contained in the accompanying report or if we can be of further assistance, please do not hesitate to contact us.

Respectfully,

ENGINEERING CONSULTING SERVICES, LTD.

David J. Schlotterer
Geologist / Project Manager

Raymond J. Franz, P.E.
Principal Engineer
New Jersey Professional Engineer No. 24GE03747400

Copies: (6) DMJMH+N

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1.0 PROJECT OVERVIEW

1.1 Executive Summary

The project consists of two proposed structures to be erected on the north side of Grissom Road located within the Mc Guire Air Force Base facility, in Wrightsville, New Jersey. One proposed structure consists of the Unit C-17 Life Support Survival Equipment Shop building that will be located in the area currently occupied by existing structures located at 2221 and 2222 Grissom Road. The other proposed structure consists of the C-17 Squadron Operations / Aircraft Maintenance building that will be located in the area currently occupied by existing structures located at 2223 and 2224 Grissom Road. It is understood that these existing buildings are to be demolished prior to construction. It is understood that new parking areas will be constructed on all sides of the proposed buildings. Existing asphalt pavements located to the north and south of the proposed buildings will be incorporated into the new development.

At the time of our field investigation, the majority of the project site was occupied by the above mentioned buildings, concrete sidewalks, and asphalt pavements. A manicured grassy area was observed in the northern portion of the site in between the existing buildings and a parking lot to the north. Overhead power lines traversed the project area. Above ground steam conduit was observed in the northern portion of the project area in the rear of the existing buildings. Large stormwater pipes, observed through drop inlets, were found to traverse west to east in the northern portion of the existing buildings in the grassy area previously mentioned.

Based on the subsurface data included herein two types of FILL material were encountered in the borings performed on this site, Types A FILL and B FILL. The Type A material is believed to consist mainly of structural fill and/or reworked natural soils that were likely placed during grading of the existing buildings. The Type A materials were predominantly Silty SANDS (SM). Very little if any debris was noted in the Type A FILL soils that were recovered from the test borings. Type A FILL soils are noted on the boring logs as Possible Fill. Type A FILL material was encountered in all of the borings, with the exception of borings B-3, B-10, and P-3. Approximately 4 ½ to 10 feet of Type A FILL was encountered below existing ground surface elevations, as indicated by the borings performed on site. The Type A FILL should be suitable for foundation, floor slab, and pavement support but will have to be fully evaluated as described in Section 4.1, and 4.2 of this report. Some undercutting of these soils may be required due to disturbance and contamination during demolition performed at the site or in areas of existing utilities. Based on the test boring data, reworking and/or undercut and replacement of some of the near surface fill soils within isolated areas of the site should be anticipated. Based on the subsurface data included herein and the layout of the proposed site plan for the project, the majority of proposed buildings area located within areas of Type A FILL.

Type B FILL represents soils that can definitively be classified as FILL due to the presence of man-made materials (asphalt) and/or unnatural organics (wood). Type B FILL soil was encountered in borings B-3, B-10 and P-3 at depths to approximately 4 to 7 feet below existing surface elevations. Existing Type B FILL materials that are free of organic and deleterious material and evaluated through test pits and determined to be stable and compact are considered suitable to receive compacted engineered fill and pavement base course material for direct support of the proposed pavements and floor slabs.

Shallow spread footings and/or a monolithic slab-on-grade with turn down edges are considered suitable foundation systems for support of the proposed buildings. The footings may be supported on suitable natural soils and/or compacted Engineered Fill. The footings may also be supported on suitable existing Type A fill soils encountered across the site. The existing Type B FILL soils encountered are not considered suitable for footing support.

Further information regarding the subsurface exploration procedures, soil conditions, foundation and floor slab design, earthwork operations and construction considerations are included in the text of this report.

1.2 Scope of Work

The conclusions and recommendations contained in this report are based on thirteen (13) soil test borings. Five (5) soil test borings (B-1 through B-5) were drilled within the proposed C-17 Life Support / Survival Equipment Shop building to depths of 30 and 40 feet below ground surface elevations. Five (5) soil test borings (B-6 through B-10) were drilled within the proposed C-17 Squadron Operations / Aircraft Maintenance Unit building to depths of 30 and 40 feet below ground surface elevations. Three (3) soil test borings (P-1 through P-3) were drilled within existing parking areas to depths of 10 feet below ground surface elevations. In addition, one (1) ground observation well was installed between the two proposed buildings to a depth of 30 feet below ground surface elevations. Two borings locations, P-4 and P-5, were omitted during drilling operations. The borings were not performed due to time constraints regarding utility clearance. These borings were eliminated from the scope and were not performed in either the original or new locations.

The borings were located in the field by ECS personnel based on the site plan provided by DMJMH+N and utilizing existing site features indicated on the plan. The approximate locations are shown on the Boring Location Diagram provided in Appendix I. Borings were located so as to avoid buried utilities and overhead power lines. Laboratory testing was performed on representative samples obtained during the field exploration to aid in the evaluation of the field data.

The recommendations contained herein were developed from our interpretation of the subsurface data obtained from the soil test borings, a site reconnaissance performed by the Geotechnical Engineer; laboratory test results; a review of available site plans indicating building layout and site boundaries. The borings indicate subsurface conditions at specific locations at the time of the exploration. If, during the course of construction, variations appear evident, the Geotechnical Engineer should be informed so that the conditions can be addressed. In addition, a review of structural drawings of the existing buildings was conducted. The drawings dated, May 20, 1955, were prepared by Porter, Urquhart & Beavin Consulting Engineers and were provided to ECS by DMJMH+N.

ECS contracted Trenton Engineering Company, Inc. to survey the exact boring locations and determine their elevations and latitudes and longitudes. This service was performed concurrently with drilling operations.

1.3 Purpose of Exploration

The purpose of this exploration was to investigate the soil and groundwater conditions at the site in order to develop engineering recommendations to aid in the design and construction of this project. This purpose was accomplished by:

- Drilling borings to explore the subsurface soil and groundwater conditions.
- Performing laboratory tests on representative soil samples obtained from the borings to evaluate pertinent engineering properties.
- Analyzing the field and laboratory data to develop appropriate engineering recommendations regarding earthwork specifications and the design of foundations, floor slabs, and pavements.

1.4 Project Characteristics

The project consists of two proposed structures to be erected on the north side of Grissom Road located within the Mc Guire Air Force Base facility, in Wrightsville, New Jersey. One proposed structure consists of the Unit C-17 Life Support Survival Equipment Shop building that will be located in the area currently occupied by existing structures located at 2221 and 2222 Grissom Road. The other proposed structure consists of the C-17 Squadron Operations / Aircraft Maintenance building that will be located in the area currently occupied by existing structures located at 2223 and 2224 Grissom Road. It is understood that these existing buildings are to be demolished prior to construction. It is understood that new parking areas will be constructed on all sides of the proposed buildings. Existing asphalt pavements located to the north and south of the proposed buildings will be incorporated into the new development. Specific traffic loading and volumes were not available at this time. It has been determined from the drawings prepared by Trenton Engineering Company. Inc. that minimal cut and fill will be required to establish pavement and building subgrade elevations. However, considering the presence of fill across the site, as well as the demolition activities required for the removal of existing structures, abandoned utilities and buried obstructions, we expect that incidental cut and fill operations will be in the order of 2 to 3 feet, and will be variable. The type of construction and foundation loading of the proposed structures were given by DMJMH+N.

The proposed structures are described in more detail as follows:

- The proposed “Unit C-17 Life Support Survival Equipment Shop” will consist of an approximately 32,800 square feet, one-story structure with masonry bearing walls and steel framing. The building will be supported on spread type footings and thickened slab sections and/or a monolithic slab with turn down edges. It is understood that the maximum loads for the wall footings and column footings are not anticipated to exceed 1 kip/lf and 150 kips, respectively. The floor for the building will be constructed as a slab-on-grade with maximum estimated loading between 100 and 150 psf.
- The “C-17 Squadron Operations / Aircraft Maintenance Unit” will consist of an approximately 31,000 square feet, two-story structure with masonry bearing walls and steel

framing. It is understood that the maximum loads for the wall footings and column footings are not anticipated to exceed 1 kip/lf and 156 kips, respectively. The floor for the building will be constructed as a slab-on-grade with maximum estimated loading between 100 and 150 psf.

It is understood that the finished floor elevations for the buildings will match the elevations of the existing buildings. As determined from the drawings provided, the finished floor elevations of the buildings are between El. 110 and El. 112.5 or within approximately 1 to 2 feet of existing surface grades.

2.0 EXPLORATION PROCEDURES

2.1 Subsurface Exploration Procedures

A total of thirteen (13) soil borings were performed to depths ranging from 10 feet to 40 feet. In addition one groundwater observation well was installed to a depth of 30 feet below ground surface elevations, in an area between the proposed buildings. The borings were performed with a truck-mounted auger drill rig that utilized continuous flight, hollow stem augers to advance the boreholes. Water was introduced in boring B-1 at depth of 23 feet, in boring B-6 at a depth of 13 feet, and boring B-8 at a depth of 30 feet. The water was added to obtain a representative soil sample and to ensure accurate blow counts. Water was added due to the presence of saturated sands encountered in the borings. Summit Site Services of Baltimore, Maryland provided the drilling services.

Representative soil samples were obtained by means of the split-barrel sampling procedure in general accordance with ASTM Specification D 1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After an initial 6 inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of cohesionless soils. Although less reliable, the SPT value can be used as an indication of the in-place consistency of cohesive soils. These indications are qualitative, since many factors such as drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies can significantly affect the standard penetration resistance value and prevent an accurate correlation between blow counts and strength and compressibility of soils.

ECS personnel maintained a field log of the soils encountered in the borings. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed in glass jars and brought to our laboratory in Richmond, Virginia for further visual examination and laboratory testing.

In addition, field resistivity tests using the Four-Pin Wenner Method were conducted at five locations at probe spacings of 5 and 10 feet.

2.2 Laboratory Testing Program

Each soil sample obtained from the test borings was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the USCS is included in Appendix III of this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in-situ; the transitions may be gradual.

Representative soil samples from the borings were then selected and tested in our laboratory to substantiate visual classifications and to determine pertinent engineering properties for use in design of foundations, earthwork and below grade walls. The laboratory testing program included moisture content, grain size analysis, and Atterberg Limits tests. In addition, modified Proctor testing (ASTM D-1557) and CBR analysis were conducted on three bulk soil samples obtained from the parking lot borings (P-1 through P-3). All data obtained from the laboratory tests are included on a summary table included in Appendix IV.

The soil samples will be retained in our laboratory for a period of 60 days after the date of this report, after which, they will be discarded unless other written instructions are received as to their disposition.

3.0 EXPLORATION RESULTS

3.1 Site Conditions

The project site is located within the Mc Guire Air Force Base facility, in Wrightsville, New Jersey. The two proposed buildings will be located in areas currently occupied by one-story masonry buildings. The existing buildings are located at 2221, 2222, 2223, and 2224 Grissom Road within the base facility.

At the time of our field investigation, the majority of the project site was occupied by the above mentioned buildings, concrete sidewalks, and asphalt pavements. A manicured grassy area was observed in the northern portion of the site in between the existing buildings and a parking lot to the north. Overhead power lines traversed the project area. Above ground steam conduit was observed in the northern portion of the project area in the rear of the existing buildings. Large stormwater pipes, observed through drop inlets, were found to traverse west to east in the northern portion of the existing buildings in the grassy area previously mentioned.

In general, the topography slopes downward from the existing parking lot in the northern area of the site to the south toward Grissom Road. Elevation changes across the entire project area are approximately 7 feet. The topography within the building areas slopes gently from the west to the east, with elevation changes approximately 3 feet. The topographic high, as noted on the drawing provided, is El. 115.4 and the topographic low is El. 108.5.

3.2 Soil Conditions

The borings encountered topsoil, asphalt, various types of fill materials and natural soils. In the grassed areas, topsoil depths ranged from 2 to 5 inches across the site. The asphalt depths recorded in the borings performed within the existing parking areas ranged from 2½ inches to 3 inches. FILL soils were encountered in all of the soil test borings. The FILL soils encountered in the test borings generally consist of two types of material that are identified herein as Type A and Type B. The Type A material is believed to consist mainly of structural fill and/or reworked natural soils that were likely placed during grading of the existing buildings. Very little if any debris was noted in the Type A FILL soils that were recovered from the test borings. Type A FILL soils are noted on the boring logs as Possible Fill. Type A FILL material was encountered in all of the borings, with the exception of boring B-3, B-10, and P-3. Approximately 4½ to 10 feet of Type A FILL was encountered below existing ground surface elevations, as indicated by the borings performed on site. The Type B FILL represents soils that can definitively be classified as FILL due to the presence of man-made materials (asphalt) and/or unnatural organics (wood). Type B FILL soil was encountered in borings B-3, B-10 and P-3 between depths of approximately 4 to 7 feet below existing surface elevations.

Type A FILL, encountered in the borings, was relatively free of deleterious material. The Type A FILL soils consisted of very loose to medium dense Silty SAND (SM). In general the subsurface across the majority of the site consists of 4.5 to 8.0 feet of Type A FILL soils. The Type A FILL soils are relatively free of debris and large amounts of organics and appear to be relatively dense as indicated by the N-Values obtained in the soil borings.

Type B FILL was encountered in borings B-3, B-10, and P-3. The Type B fill material was encountered from the ground surface to depths of 4 to 7 feet below the existing ground surface grades. The Type B FILL soils encountered borings B-3 and B-10 were defined by a 1 inch asphalt layer encountered at an approximate depth of 4 feet below the surface elevation. We believe the presence of the asphalt layer represents an old parking lot that was filled over to create the existing parking area located at the eastern side of the building at 2224 Grissom Road. The Type B FILL soils encountered in boring B-3 were defined by the presence of wood fragments observed in the boring at approximately 7 feet below the ground surface elevation. The Type B FILL soils consisted of very loose to dense Silty SAND (SM).

In general, the natural soils encountered generally consist of erratic deposits of very loose to dense Silty SAND (SM) and Poorly Graded SAND with Silt (SP-SM) overlying deposits of soft to medium stiff consistency Sandy SILT (ML) and Sandy Lean CLAY (CL).

Boring logs describing soil conditions encountered are included in Appendix II of this report.

3.3 Groundwater Observations

Groundwater was encountered in all of the soil test borings performed. A groundwater observation well (MW-1) was also installed in an area between the two proposed buildings to a depth of 30 feet below the ground surface elevation. Groundwater was encountered in the borings between the depths of 2½ and 7 feet below existing ground surface elevations. Groundwater was recorded in the water observation well at a depth of 5½ feet (El. 104.5) below

existing ground surface elevations immediately after installation and 5.25 feet (El. 104.9) after 30 hours. Water level readings could not be obtained after 24 hours in the borings due to near surface borehole cave-in, with the exception of boring B-3. Groundwater was recorded at a depth of 2.5 feet below surface elevations in boring B-3 24 hours after drilling. For construction purposes, we recommend that the groundwater level recorded in the monitoring well, El. 104.9, be utilized for construction. In addition, the water level in the monitoring well can be checked prior to and during construction. Following removal of the augers all of the borings caved at depths between 3 feet and 6½ feet. These cave-in depths were recorded 24 hours after completion of drilling. Borehole cave-in (collapse) often indicates wet and unstable conditions.

Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration. Groundwater is not expected to adversely impact general grading operations but should impact deep excavations.

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 Subgrade Preparation and Earthwork Operations

Subgrade preparation for all structures, roads and parking areas should consist of removing all topsoil, rootmat, buried and/or subsurface debris, and any other soft or unsuitable material from the proposed structures and pavement areas. Demolition operations should include complete removal of all foundations, slabs, pavements, buried utilities and tanks (if present), and all debris. Existing structures and abandoned utilities may be left in place below new pavements provided these structures are at least 2 ft below design pavement subgrade levels and approved by the Geotechnical Engineer. It should be expected that wet soil conditions or perched water that is trapped within existing uncontrolled fill and buried debris may be encountered during construction operations. Where encountered in shallow excavations (less than 5 feet), we anticipate seepage can be controlled through simple dewatering measures (trenching and sump-pumps).

Whenever construction occurs where previous facilities have existed, there is a greater possibility of uncovering unanticipated debris, unsuitable soil and FILL materials, and other conditions that will require recompaction and/or replacement. Although we have addressed the procedures for dealing with some of these factors in this report, it is impossible to predict all "unanticipated" conditions. Nonetheless, we strongly urge that a contingency be established in the construction budget for dealing with unexpected utilities, unsuitable soil and deep FILL, and debris that may be encountered and/or uncovered during construction.

The depth of topsoil recorded in the test borings was between 2 and 5 inches within the grassy open areas of the site. The depth of asphalt recorded in the test borings was between 2½ and 3 inches within the paved areas of the site. Based on the test boring data, we recommend that an average topsoil stripping depth of 6 inches be considered for planning purposes within the open grass covered areas of the site. Actual, stripping depths should be evaluated by the Geotechnical Engineer during construction.

As previously mentioned, two types of FILL material were encountered in the majority of the borings performed on this site. The Type A material is believed to consist mainly of structural fill and/or reworked natural soils that were likely placed during grading of the existing building pads. Existing Type A FILL materials that are free of organic and deleterious material and evaluated through test pits and determined to be stable and compact are considered suitable to receive compacted Engineered Fill, for direct support of the proposed buildings, and pavements. Based on the test boring data, reworking and/or undercut and replacement of some of the near surface fill soils within isolated areas of the site should be anticipated. Based on the subsurface data included herein and the layout of the proposed site plan for the project, the majority of proposed buildings area located within areas of Type A FILL.

Type B FILL represents soils that can definitively be classified as FILL due to the presence of man-made materials (asphalt) and/or unnatural organics (wood). Existing Type B FILL materials that are free of organic and deleterious material and evaluated through test pits and determined to be stable and compact are considered suitable to receive compacted engineered fill and pavement base course material for direct support of the proposed pavements and floor slabs. **Type B FILL soils are not considered suitable for foundation support.** Please see Section 4.2 for further information regarding foundations.

The depth of FILL reported herein should be considered approximate and representative of the boring location only. In this regard, deeper FILL could be present on site. Therefore, the actual depth and extent of undercut of unsuitable FILL soils should be evaluated in the field by the Geotechnical Engineer. Undercut volumes should be determined by cross-sectioning the area before and after undercut. We have found that calculating undercut volumes by truck counts is less accurate and generally results in additional expense to the Owner.

Actual depths of undercut will depend upon the final subgrade elevations and will likely vary at any given location. In the event that large areas of unstable and unsuitable subgrade is encountered in pavement areas only, stabilization utilizing a geotextile, a geogrid, moderate undercutting or a combination of these remedial measures, could be considered under the advisement of the Geotechnical Engineer. We recommend earthwork clearing and undercutting to remove unsuitable site material be extended a minimum of 5 feet beyond the building limits and 2 feet beyond the pavement limits.

After removing all unsuitable materials, cutting to the desired grade and prior to Engineered Fill placement, subgrades should be observed by the Geotechnical Engineer or Engineering Technician. Proofrolling using a large vibratory, smooth-drum roller can be used to evaluate the subgrade soils. Any soft, loose or unsuitable materials should be densified to the extent practical or should be removed and replaced with properly compacted Engineered Fill as directed by the Geotechnical Engineer.

In a dry and undisturbed state, the subgrade soils at the site will provide suitable subgrade support for fill placement and construction operations, except perhaps in the low lying and wetland areas. However, when wet, this soil will degrade quickly either with or without disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations so as to help maintain the stability of the soil. We recommend that the design depths of stone be placed in the pavement areas early in the construction so as to help protect these subgrades.

All Engineered Fill should be placed in horizontal, maximum 8-inch loose lifts and should be compacted to a minimum of 95% of the maximum dry density determined in accordance with ASTM Specification D698, Standard Proctor Method. The moisture content at the time of placement should be within 3% of the optimum moisture content as determined by the appropriate Proctor results. Non-structural backfill should be compacted to at least 90% ASTM D698. Compacted fill subgrades with a slope steeper than 4H:1V should be benched to allow placement of horizontal lifts. In-place density tests should be performed with a minimum of 1 test per 2,500 square feet in building areas and 1 test per 5,000 square feet in general site areas for each lift of fill placed but not less than three tests per lift.

Successful reuse of excavated, on-site soils as Engineered Fill will depend on the natural moisture content of the soils encountered during excavation. Based on the moisture content data obtained from the laboratory testing, some scarifying and drying of the on-site soils encountered above the water table may be required to achieve adequate compaction. Drying of these soils will likely result in delays, and drying may not be possible during the late fall and winter. Accordingly, we recommend that the earthwork be performed during the warmer, drier times of the year. Silty soils are moisture sensitive and can be difficult to work. Experienced earthwork contractors should be pre-qualified for Engineered Fill work.

The following fill types are recommended for use on this project:

Imported Engineered Fill: Soil Material obtained from off-site sources classified as CL, SC, SM, SP, SW, GM, GP or GW which contains less than about 60% by weight Silt or Clay and is free of organics and debris. Maximum aggregate size shall be limited to 3 inches. Suitable material should have a maximum Liquid Limit of 25 and maximum Plasticity Index of 15. As an alternative, ASTM D448-86 No. 10 Stone Screenings are considered acceptable.

On-Site Borrow Engineered Fill: Soil Material obtained from on-site sources classified as SC, SM, SP, SW, GM, GP or GW which contains less than about 50% by weight Silt or Clay and is free of organics and debris. Maximum aggregate size shall be limited to 3 inches. Suitable material should have a maximum Liquid Limit of 40 and maximum Plasticity Index of 30. The majority of on site soils should be suitable for use as Engineered Fill.

Porous Fill: Clean crushed gravel (ASTM D448-86 No. 57 Stone) with a maximum aggregate size of 1.0 inch placed in a minimum 4 inch layer below exterior slabs.

Aggregate Base: Aggregate Base Material, Dense Graded Aggregate such as NJDOT 901.08 or Soil Aggregate I-5.

4.2 Foundations

Based on the results of our subsurface exploration, shallow spread footings are considered suitable for support of the proposed buildings and any retaining walls. Alternatively, a monolithic slab-on-grade with integral footing (turn down edges) foundation system may be employed. The footings may be supported on suitable natural soils and/or Engineered Fill. The footings may also be supported on suitable existing Type A FILL soils encountered across the

site. The existing Type B FILL soils encountered in the soil test borings are not considered suitable for footing support. To reduce the potential for differential settlement, the monolothic slab-on-grade option should provide more uniform support to the structures.

We recommend that a net allowable soil bearing pressure of 1,500 psf be utilized for square and/or continuous footings. This allowable soil bearing pressure provides a factor of safety of at least 3.0 against general shear failure. We recommend that all footings have a minimum width of 18 inches for strip (wall) footings and 24-inches for pier (column) footings. A minimum width of 12-inches should be used for turned-down edges. Footing bottoms should be located at least 36 inches below finished exterior grades for frost protection and bearing capacity considerations.

Based on footings designed utilizing a net allowable soil bearing pressure of 1,500 psf, the total settlement for the proposed structures is estimated to be in the range of 1 inch or less, with differential settlements estimated to be one half that amount.

The results of our laboratory testing and test boring data indicate that the soils at proposed foundation bearing level possess **low shrink-swell** characteristics. Adequate drainage as discussed in Section 4.7 should be provided so water does not accumulate around the building foundations walls. In addition, gutters and downspouts should be provided to collect and convey roof water of least 5 feet beyond the building limits.

A very important aspect of foundation construction is the inspection process of foundation subgrades especially for footings that are to be supported on the existing Type A FILL. For buildings that will bear in Type A FILL, a handauger probe should be performed to 5 feet below the footings bottoms to ensure that any deleterious and organic material does not exist under the foundations. A handauger probe should be performed approximately every 25 linear feet of footing at the discretion of the Geotechnical Engineer and at each individual footing location. In addition to the handaugers, a Dynamic Cone Penetrometer (DCP) test should be performed at the handauger locations to ensure the bearing capacity of the soils meets or exceed 1,500 psf.

Footing subgrades that require undercut to remove unsuitable existing fill and/or natural soils can be restored to design grade utilizing ASTM D448-86 No. 57 Stone, footing concrete or Engineered Fill.

Seismic Site Coefficient

According to the 1999 BOCA National Building Code, Section 1610.3.1, the site soils appear to qualify as Soil-Profile Type S_2. The Seismic Site Coefficient (S) for this soil profile is 1.2.

4.3 Floor Slab Design

Floor slabs may be supported on suitable natural soils, approved Type A and B FILL soils or Engineered Fill. For the construction of floor slabs we recommend that the subgrade be prepared as recommended in Section 4.1.

A modulus of subgrade reaction, k, of 200 pci may be used to design the floor slab. Floor slab

subgrades should be observed by an experienced Geotechnical Engineer during the time of construction to aid in locating any soft or unsuitable materials. Engineered Fill placed for support of floor slabs should satisfy the criteria outlined in Section 4.1 of this report.

The floor slabs for the proposed buildings could be constructed independent of the foundation system and/or as monolithic slabs-on-grade. Also, in order to minimize the crack width of any shrinkage cracks that may develop near the surface of the slab, we recommend mesh reinforcement be included in the design of the floor slab. The mesh should be in the top half of the slab to be effective.

We recommend that any floor slab areas where excessive deflection cannot be tolerated such as the high density equipment storage area be post-tensioned.

We recommend the slabs-on-grade be underlain by a minimum of 4 inches of clean, crushed, angular gravel (crushed stone) having a maximum aggregate size of 1.5 inches. ASTM D448-86 No. 57 Stone is considered suitable for this purpose. This porous fill layer will facilitate the fine grading of the building pad, provide more uniform bearing conditions, and help prevent the rise of water to the bottom of the slab (capillary action). As an alternate, a 6-inch layer of Aggregate Base Material, NJDOT Dense Graded Aggregate 901.08 can be employed beneath the slabs. Floor slab subgrades should be recompacted immediately before placing the porous fill to repair any disturbance that may have occurred due to construction operations. Prior to concrete placement a 6-mil poly vapor barrier should be placed on top of the granular material to provide additional moisture protection. Based on the anticipated finished grade elevations, underdrains for slabs and perimeter drains for footings are not considered necessary.

4.4 Pavements

For the construction of new pavements, we recommend that the subgrade be prepared as recommended in Section 4.1. Based on the results of our soil test borings and laboratory test data it appears that the soils that will be exposed as pavement subgrades will consist mainly of Silty SAND (SM). The CBR samples obtained were compacted to densities based on the modified Proctor method ASTM D-1557. CBR values of 43.3, 53.0, and 51.7 were obtained after soaking the samples for four days. We anticipate that the majority of these soils at the design pavement grades will consist of existing Type A FILL material. To achieve the CBR values in the field, additional densification of subgrades will be necessary beyond simple proofrolling. Careful control and monitoring of densification must by implemented.

An important consideration with regard to the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials becoming saturated over a long period of time. Based upon the results of the soil test borings, the groundwater table should not significantly affect the performance of pavements; however, surface runoff water that is trapped during construction on the exposed subgrade soils could create localized deterioration of the soil's bearing capacity. Standing water that may develop on the surface of the pavement may be minimized by adequate design (surface graded to control runoff to desired locations - catch basins, drain inlets, gutters,

etc.), adequate compaction of each lift of pavement section component material (to minimize localized settlements that result in ponding) and accurate grading of each lift of pavement section component material (to achieve the desired design grades). Standing water that tends to develop within the base course layer may be minimized by installing temporary weep holes in drainage structures, construction of drainage swales and diversion ditches, and proper backfill and grading behind curbs to minimize water intrusion from behind the curbs.

Pavement subdrains or drainage ditches should be provided behind curbs in cut areas where the grades slope toward the pavements. The invert grade of swales should be at least 1 foot below the pavement subgrade level. Pavement subdrains should be daylighted or connected to a storm sewer.

In lieu of specific traffic estimates, we have developed the following preliminary pavement section recommendations for the project. These recommendations are based on the results of our subsurface exploration and laboratory testing programs, and Site Improvement guidelines from the State of New Jersey.

Recommended Pavement Sections

Recommended Pavement Section	Heavy Traffic Areas (in.)	Parking Stalls (in.)
Bituminous concrete surface course	1.5	1.5
Bituminous base course	3	2.5
Granular Base (NJDOT Dense Graded Aggregate or Soil Aggregate I-5)	8	6

4.5 Soil Corrosivity

Field resistivity and laboratory testing were used to evaluate the general potential corrosivity of the soil to ductile cast-iron pipe and concrete. Laboratory testing for corrosivity factors included moisture, pH, Sulfate content, and resistivity. The corrosivity of the soils encountered within 10 feet of the ground surface is considered to be moderate due to the relatively low pH values and moderate Sulfate contents. Corrosivity to gray or ductile cast-iron pipe is moderate. Corrosivity to concrete structures is moderate. We recommend that below grade metallic pipe be protected from corrosion by encasing the pipe in a polyethylene or other suitable corrosion resistant material. Alternatively, a cathodic protection system can be installed to reduce metallic pipe corrosion. We recommend that concrete structures be cast from concrete meeting 1999 BOCA requirements for concrete exposed to sulfate-containing solutions or soils. The concrete should conform to moderate sulfate exposure requirements outlined in Table 1907.1.3. For corrosion protection of reinforcement in concrete, we recommend the maximum water-soluble chloride ion concentrations in concrete shall not exceed the limitations established in ACI 318. Tables summarizing the field and laboratory testing can be found below.

FIELD RESISTIVITY TESTING USING 4-PIN WENNER METHOD

TEST LOCATION *	TEST DEPTH FEET	RESISTIVITY ** Ω-CM
R-1	5	14,362
R-1	10	3,850
R-2	5	11,490
R-2	10	11,107
R-3	5	10,150
R-3	10	7,085
R-4	5	21,065
R-4	10	10,915
R-5	5	22,980
R-5	10	12,639

* Please refer to the Boring Location Diagram in Appendix I for actual locations
** Formula used to calculate Resistivity – Resistivity = 191.5 x Pin Spacing in feet x Resistance

LABORATORY TESTING SUMMARY

BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	pH	SULFATE mg/kg	RESISTIVITY Ω-CM
B-1	S-1	0-2	--	--	4,600
B-1	S-2 & 3	2-6	--	--	5,600
B-1	S-4 & 5	6-10	--	--	21,000
B-3	S-4 & 5	6-10	4.51	--	22,000
B-4	S-5	8-10	--	BDL	--
B-5	S-5	8-10	4.52	280	--
B-7	S-3	4-6	--	160	--
B-8	S-5	8-10	4.15	150	--
B-10	S-4 & 5	6-10	4.30	--	21,000

BDL = Below Detection Limit
Detection Limit = 58 mg/kg
-- = Test Not Performed

4.6 Site Drainage

Positive drainage should be provided around the perimeter of the building and/or structures to minimize moisture infiltration into the foundation/subgrade soils. We recommend landscaped

areas adjacent to these structures be provided with a fall of at least 6 inches for the first 10 feet outward from the structures. The parking lot, sidewalks, and any other paved areas should be sloped away from the proposed building.

In order to enhance pavement performance and help protect subgrades, we recommend that ditches and/or subdrains be employed around the perimeter of pavements as discussed in Section 4.4. We do not anticipate groundwater to be encountered during general earthwork operations. However, if encountered, temporary dewatering measures such as trenching and/or pumping from sumps should be sufficient to control surface water and/or groundwater. However, deep excavations below the water table will require aggressive dewatering methods such as well-pointing to remove water from the excavation. Dewatering methods employed should be the responsibility of the contractor.

4.7 Construction Considerations

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete.

Required site elevations can be restored with compacted structural Fill (Engineered Fill). Engineered Fill should satisfy the criteria outlined in Section 4.1 of this report. Where localized unsuitable Type B FILL and/or soft soils are encountered during construction, footing excavations should penetrate the Type B FILL, and footing grades restored with ASTM D448-86 No. 57 Stone, footing concrete or other engineered backfill approved by the Geotechnical Engineer.

The bearing capacity at the final footing elevation should be verified in the field by an experienced Geotechnical Engineer or qualified representative to assure that the in-situ bearing capacity at the bottom of each footing excavation is adequate for the design loads recommended in this study. In addition, for buildings that will bear in Type A FILL, a handauger probe should be performed to 5 feet below the footings bottoms to ensure that any deleterious and organic material does not exist under the foundations. A handauger probe should be performed approximately every 25 linear feet of footing at the discretion of the Geotechnical Engineer and at each individual footing location. In addition to the handaugers, a Dynamic Cone Penetrometer (DCP) test should be performed at the handauger locations to ensure the bearing capacity of the soils meets or exceed 1,500 psf.

All Engineered Fill materials should be placed, compacted, and tested in accordance with the recommendations contained in this report. We recommend that all cut and fill operations be observed on a full-time basis by a qualified Soil Technician to determine if minimum earthwork and compaction requirements are being met.

In a dry and undisturbed state, the subgrade soils at the site will provide suitable subgrade support for FILL placement and construction operations. However, when wet, this soil will degrade quickly either with or without disturbance from contractor operations. Therefore, good

site drainage should be maintained during earthwork operations so as to help maintain the stability of the soil. We recommend that the design depths of stone be placed in the pavement areas early in the construction so as to help protect these subgrades. Alternatively, the existing pavements and/or aggregate base could be left in place during building construction, so as to protect the subgrade and provide a good working surface for construction activity. Any subgrades left exposed to precipitation will quickly degrade, regardless of the construction traffic exposure. Attempting sitework during adverse seasonal conditions will have significant effect on the sitework budget as substantially more undercutting will be required. Ideally, earthwork should be performed during the summer or early fall (typically drier and warmer months).

The construction contract should include a fair unit rate for undercut and backfilling with compacted structural FILL, ASTM D448-86 No. 57 Stone or NJDOT Dense Graded Aggregate 901.08 as soft subgrade conditions and unsuitable FILL requiring undercut will be encountered. Furthermore, a unit rate for geotextiles and geogrids should be provided in the event that soil stabilization is required for large areas.

We recommend that construction requiring deep excavations, such as storm water management piping, be installed **prior to the construction of the foundations** to reduce the risk of foundation settlement. This is important because, as previously stated, aggressive dewatering methods may have to be employed to depress the water table. Due to the sandy nature of the subsurface soil strata, settlement can occur within bearing soils due to the rapid drop/increase in the water table.

5.0 CLOSING

We recommend that the construction activities be monitored by a qualified geotechnical engineering firm to provide the necessary overview and to check the suitability of the subgrade soils for supporting the footings. We would be most pleased to provide these services.

APPENDIX I

BORING LOCATION DIAGRAM

ISSUED WITH PLANS IN AMENDMENT 3

APPENDIX II

SOIL BORING LOGS

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-1	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 111.46

CALIBRATED PENETROMETER TONS/FT. 2 (1 2 3 4 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % (●) — LIQUID LIMIT % (Δ) (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. (⊗) (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	24	24	Silty Fine to Coarse SAND Trace Gravel, Brown, Moist, Loose to Medium Dense (SM/POSSIBLE FILL)	110
	2	SS	24	24		
5	3	SS	24	24	Silty Fine to Coarse SAND Trace Gravel, Tan, Moist, Loose (SM)	
	4	SS	24	24	Silty Fine SAND Contains Mica, Orangish and Grayish Brown, Wet to Saturated, Very Loose (SM)	105 ▽
10	5	SS	24	24		
					Silty Fine to Coarse SAND Trace Fine Gravel, Brown, Saturated, Medium Dense (SM)	100
15	6	SS	24	24		
						95
20	7	SS	24	24	Silty Fine to Coarse SAND Contains Mica, Dark Gray, Moist, Medium Dense (SM)	
						90
25	8	SS	24	24		
						85
30	9	SS	24	24		

Penetrometer profile: 8, 13, 7, 4, 2, 11, 11, 14, 13

MC 13.2% (at ~7)

MC 31.1% (at ~11)

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 7'	WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 4"
▽WL(AB) ▽WL(AC)		BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 8' @ 24 HRS 3.5'
▽WL		RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
MC GUIRE AFB	DMJMH+N

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 111.98

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Tan, Moist, Loose (SM/POSSIBLE FILL)		7
	2	SS	24	24	Silty Fine to Coarse SAND With Fine to Medium Gravel, Brown, Moist, Medium Dense (SM/POSSIBLE FILL)	110	13
5	3	SS	24	24			23
	4	SS	24	24	Silty Fine to Coarse SAND Trace Gravel, Black, Moist, Medium Dense (SM/POSSIBLE FILL)	▽105	27
	5	SS	24	24	Silty Fine to Coarse SAND, Grayish Brown, Moist to Wet, Medium Dense to Loose (SM)		10 MC 16.1%
10						100	
	6	SS	24	24	Silty Fine to Coarse SAND With Fine to Medium Gravel, Medium Gray, Saturated, Medium Dense (SM)		13
15						95	
	7	SS	24	24	Silty Fine to Coarse SAND, Contains Mica, Dark Gray, Wet, Medium Stiff (SM)		6 MC 28.8%
20						90	
	8	SS	24	24	Silty Fine to Medium SAND, Contains Mica, Dark Gray, Wet, Medium Dense to Very Loose (SM)		11
25						85	
	9	SS	24	24			3
30							

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 7' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 4"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 13' @ 24 HRS 3.0'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-3	1 OF 2
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION: MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 111.18

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % — LIQUID LIMIT % (Δ) (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. (⊗) (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Medium SAND, Tan, Moist, Very Loose (SM/FILL)	110	5
	2	SS	24	24			3
5	3	SS	24	24	Silty Fine to Coarse SAND Trace Fine Gravel, Orangish Brown and Tan, Moist, Loose (SM/FILL) NOTE: CONTAINS THIN LENSE OF DARK GRAY SILTY SAND	105	8
	4	SS	24	24			7
	5	SS	24	24	Silty Fine to Coarse SAND, Contains Wood Fragments, Dark Gray, Wet, Loose (SM/FILL)		8
10					Silty Fine to Coarse SAND, Greenish Brown, Wet, Loose (SM)	100	
	6	SS	24	24	Silty Fine to Coarse SAND, Medium Gray, Wet to Saturated, Medium Dense to Loose (SM)		21 ● MC 24.1%
15					Poorly Graded Fine to Coarse SAND with Silt, Light Gray, Saturated, Loose (SP-SM)	95	
	7	SS	24	24			8
20						90	
	8	SS	24	24	Silty Fine SAND, Contains Mica, Dark Gray, Wet, Medium Dense (SM)		15
25						85	
	9	SS	24	24	Fine Sandy SILT, Dark Gray, Moist, Medium Stiff to Soft (ML)		11
30							

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 3.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 3"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH ● 6.0'
▽WL @ 24 HRS 2.5'	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-3	2 OF 2
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 111.18

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
30					Fine Sandy SILT, Dark Gray, Moist, Medium Stiff to Soft (ML)	110	
35	10	SS	24	24		105	4
	11	SS	24	24			11
40					END OF BORING @ 40.0'	100	
45						95	
50						90	
55						85	
60							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 3.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 3"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 6.0'
▽WL @ 24 HRS 2.5'	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-4	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.77

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	24	Silty Fine to Coarse SAND Trace Gravel, Orangish Brown, Moist, Very Loose to Medium Dense (SM/POSSIBLE FILL)
	2	SS	24	24	
5	3	SS	24	24	Silty Fine to Medium SAND, Orangish Brown and Tan, Moist, Dense (SM)
	4	SS	24	24	Silty Fine to Coarse SAND, Medium Gray, Moist to Wet, Loose (SM)
	5	SS	24	24	
10					Silty Fine to Coarse SAND, Greenish to Medium Gray, Saturated, Medium Dense (SM)
	6	SS	24	24	
15					
					Silty Fine SAND Contains Mica, Dark Gray, Wet, Loose (SM)
	7	SS	24	24	
20					
	8	SS	24	24	
25					
					Fine Sandy Lean CLAY Contains Mica, Dark Gray, Moist, Medium Stiff (CL)
	9	SS	24	24	
30					

WATER LEVELS ELEVATION (FT)

CALIBRATED PENETROMETER TONS/FT.^{2}
1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △
10 20 30 40 50+

STANDARD PENETRATION BLOWS/FT. ⊗
10 20 30 40 50+

5 18 31 MC 11.6% 9 23 14 8 4 6 MC 38.7% 22% 37%

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 6.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 5"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 7.5' @ 24 HRS 4.5'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-5	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.37

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0	1	SS	24	2	Silty Fine to Coarse SAND, Orangish Brown, Moist to Wet, Very Loose (SM/POSSIBLE FILL)
	2	SS	24	2	
5	3	SS	24	2	Silty Fine to Coarse SAND Contains Mica, Dark Brown, Moist, Medium Stiff (SM)
	4	SS	24	2	
	5	SS	24	2	Silty Fine to Coarse SAND, Light Gray, Saturated, Very Loose (SM)
10					
	6	SS	24	2	Silty Fine SAND, Contains Mica, Dark Gray, Wet, Loose to Medium Dense (SM)
15					
	7	SS	24	2	
20					
	8	SS	24	2	
25					
	9	SS	24	2	Fine Sandy SILT, Contains Mica, Dark Gray, Moist, Medium Stiff (ML)
30					

END OF BORING @ 30.0'

WATER LEVELS ELEVATION (FT): 110, 105, 100, 95, 90, 85

CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △: 10 20 30 40 50+

STANDARD PENETRATION BLOWS/FT. ⊗: 10 20 30 40 50+

4, 2, 8, 9, 2, 8, 19, 13, 10

MC 23.6%

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 2"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH ● 7.5' @ 24 HRS 3.0'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
MC GUIRE AFB	DMJMH+N

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 109.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	CALIBRATED PENETROMETER TONS/FT.²	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Orangish Brown and Tan, Moist to Saturated, Medium Dense to Very Loose (SM/POSSIBLE FILL)	105		12
	2	SS	24	24				20
5	3	SS	24	24				10
	4	SS	24	24				7
	5	SS	24	24		100		1
10					Silty Fine SAND Contains Mica, Dark Gray, Wet, Loose (SM)			
	6	SS	24	24		95		5
15								
	7	SS	24	24		90		13
20					Fine Sandy SILT Contains Mica, Dark Gray, Moist to Wet, Medium Stiff (ML)			
	8	SS	24	24		85		6
25								
	9	SS	24	24		80		9
30					Silty Fine to Coarse SAND, Greenish Blue, Wet (SM)			

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

MC 17.7%

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5.5'	WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 2"
▽WL(AB)	▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 7' @ 24 HRS 3.0'
▽WL		RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-7	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.3

CALIBRATED PENETROMETER TONS/FT.^{2} (1, 2, 3, 4, 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % (●) — LIQUID LIMIT % (Δ)

STANDARD PENETRATION BLOWS/FT. (⊗) (10, 20, 30, 40, 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Orangish Brown, Moist, Loose to Medium Dense (SM/POSSIBLE FILL)	110	7
	2	SS	24	24			15
5	3	SS	24	24		105 ▽	26
	4	SS	24	24			14
	5	SS	24	24	Silty Fine SAND, Contains Mica, Dark Gray, Moist, Medium Stiff (SM)		19
10					Silty Fine to Medium SAND, Light Gray, Moist to Wet, Medium Dense (SM)	100	
	6	SS	24	24	Silty Fine SAND, Contains Mica, Dark Gray, Saturated, Loose to Medium Dense (SM)		7
15						95	
	7	SS	24	24			30
20						90	
	8	SS	24	24			6
25						85	
	9	SS	24	24	Fine Sandy SILT, Contains Mica, Dark Gray, Moist, Medium Stiff (ML)		9
30							

MC 23.3%

MC 37.5%

29%

45%

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL 5.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 4"
▽ WL(AB) ▽ WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 7.5' @ 24 HRS 4.5'
▽ WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-8	1 OF 2
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION: MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.19

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	24	24	Silty Fine to Medium SAND, Orangish Brown and Tan, Moist to Saturated, Loose to Medium Dense (SM/POSSIBLE FILL)	
	2	SS	24	24		
5	3	SS	24	24		105
	4	SS	24	24	Poorly Graded SAND With Silt, Orangish Brown and Tan, Saturated, Loose (SP-SM)	
	5	SS	24	24	Silty Fine to Coarse SAND, Greenish Gray, Saturated, Very Loose (SM)	
10						100
	6	SS	24	24	Silty Fine SAND, Contains Mica, Dark Gray, Saturated, Very Loose (SM)	
15						95
	7	SS	24	24		
20						90
	8	SS	24	24	Fine to Coarse Sandy SILT, Contains Mica, Dark Gray, Wet, Medium Stiff (ML)	
25						85
	9	SS	24	24	Silty Fine to Coarse SAND, Contains Mica, Greenish Gray, Saturated, Loose to Dense (SM)	
30						

MC 19.0%

MC 21.8

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 4"
▽WL(AB) ▼WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH ● 19.5' ◎ 24 HRS 4.0'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-8	2 OF 2

PROJECT NAME	ARCHITECT-ENGINEER
MC GUIRE AFB	DMJMH+N

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.19

CALIBRATED PENETROMETER TONS/FT.^{2} (1, 2, 3, 4, 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % (●) — LIQUID LIMIT % (Δ) (10, 20, 30, 40, 50+)

STANDARD PENETRATION BLOWS/FT. (⊗) (10, 20, 30, 40, 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
30					Silty Fine to Coarse SAND, Contains Mica, Greenish Gray, Saturated, Loose to Dense (SM)		
35	10	SS	24	24		105	42
	11	SS	24	24			24
40					END OF BORING @ 40.0'	100	
45						95	
50						90	
55						85	
60							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5.5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 4"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 19.5' @ 24 HRS 4.0'
▽WL	RIG FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-9	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 109.28

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	CALIBRATED PENETROMETER TONS/FT.² / STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Orangish Brown and Tan, Moist to Saturated, Very Loose (SM/POSSIBLE FILL)		5
	2	SS	24	24			2
5	3	SS	24	24		105	3 MC 19.8%
	4	SS	24	24			2
	5	SS	24	24	Silty Fine to Coarse SAND, Trace Gravel, Gray, Saturated, Very Loose (SM)	100	2 MC 31.0%
10							
	6	SS	24	24		95	3
15							
	7	SS	24	24	Silty Fine SAND, Contains Mica, Gray, Wet, Medium Dense (SM)	90	25
20							
	8	SS	24	24	Silty Fine to Coarse SAND, Contains Mica, Dark Gray, Wet, Medium Dense (SM)	85	12
25							
	9	SS	24	24	Fine Sandy SILT, Contains Mica, Dark Gray, Moist, Medium Stiff (ML)	80	7
30							

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5' WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 3"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH @ 6' @ 24 HRS 3.5'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	B-10	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 109.73

CALIBRATED PENETROMETER TONS/FT.^{2} (1, 2, 3, 4, 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10, 20, 30, 40, 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10, 20, 30, 40, 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Orangish Brown to Brown, Moist, Very Loose to Medium Dense (SM/FILL)		5
	2	SS	24	24			20
					ASPHALT (FILL)	105	
5	3	SS	24	24			21
	4	SS	24	24	Silty Fine to Coarse SAND, Orangish Brown, Moist, Medium Dense (SM/POSSIBLE FILL)		18
	5	SS	24	24	Silty Fine to Coarse SAND, Greenish Gray, Moist to Wet, Medium Dense to Loose (SM)		20
10						100	
	6	SS	24	24			6 MC 15.7%
15						95	
	7	SS	24	24	Silty Fine to Coarse SAND Contains Mica, Dark Gray, Wet, Loose (SM)		9 MC 30.6%
20						90	
	8	SS	24	24	Silty Fine SAND Contains Mica, Dark Gray, Wet, Medium Dense (SM)		11
25						85	
	9	SS	24	24	Silty Fine SAND With Coarse Sand Layers, Contains Mica, Dark Gray, Wet, Loose (SM)		10
30						80	

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 7'	WS OR WD	BORING STARTED 05/20/02	TOPSOIL DEPTH 2"
▽WL(AB)	▽WL(AC)	BORING COMPLETED 05/20/02	CAVE IN DEPTH ● 12' @ 24 HRS 6.0'
▽WL		RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	P-1	1 OF 1
PROJECT NAME	**ARCHITECT–ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 111.42

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % (●) — LIQUID LIMIT % (Δ) (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. (⊗) (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Trace Gravel, Orangish Brown and Tan, Moist, Medium Dense (SM/POSSIBLE FILL)	110	29
	2	SS	24	24			21
5	3	SS	24	24	Silty Fine to Coarse SAND, Greenish Gray, Moist, Medium Dense (SM/POSSIBLE FILL)	105	12
	4	SS	24	24	Silty Fine to Coarse SAND, Dark Gray, Moist, Medium Dense to Loose (SM/POSSIBLE FILL)		10
10	5	SS	24	24	Silty Fine to Coarse SAND, Greenish Gray, Saturated, Medium Dense (SM)	100	19
					END OF BORING @ 10.0'		
15						95	
20						90	
25						85	
30							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 8.0' WS OR WD	BORING STARTED 05/23/02	ASPHALT/STONE 3"/6.5"
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/23/02	CAVE IN DEPTH @ 7' @ 24 HRS 6.5'
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	P-2	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 110.07

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Trace Gravel, Orangish Brown, Moist, Medium Dense (SM/POSSIBLE FILL)		21
	2	SS	24	24			23
5	3	SS	24	24	Silty Fine to Coarse SAND, Medium Brown, Moist, Dense (SM/POSSIBLE FILL)	▽105	41
	4	SS	24	24	Silty Fine to Coarse SAND, Light Gray, Wet, Medium Dense (SM)		17
10	5	SS	24	24	Poorley Graded SAND With Silt, Light Gray, Saturated, Medium Dense (SP-SM)	100	19
					END OF BORING @ 10.0'		
15						95	
20						90	
25						85	
30							

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 5'	WS OR WD	BORING STARTED 05/23/02	ASPHALT/STONE 2.5"/6.5"
▽WL(AB)	▼WL(AC)	BORING COMPLETED 05/23/02	CAVE IN DEPTH @ 6.5' @ 24 HRS 5.0'
▽WL		RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER

CLIENT	JOB #	BORING #	SHEET
DMJMH+N	7289	P-3	1 OF 1
PROJECT NAME	**ARCHITECT-ENGINEER**		
MC GUIRE AFB	DMJMH+N		

SITE LOCATION
MC GUIRE AFB, NEW JERSEY

ENGLISH UNITS

SURFACE ELEVATION 109.05

CALIBRATED PENETROMETER TONS/FT.^{2} (1 2 3 4 5+)

PLASTIC LIMIT % (X) — WATER CONTENT % — LIQUID LIMIT % (Δ) (10 20 30 40 50+)

STANDARD PENETRATION BLOWS/FT. (⊗) (10 20 30 40 50+)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Silty Fine to Coarse SAND, Trace Gravel, Orangish Brown, Moist, Dense (SM/FILL)		
	2	SS	24	24	Silty Fine to Coarse SAND, Trace Gravel, Grayish Brown and White, Moist, Dense (SM/FILL)		
5	3	SS	24	24	ASPHALT	105	
	4	SS	24	24	Silty Fine to Coarse SAND, Reddish Brown and Dark Gray, Moist, Medium Dense (SM/POSSIBLE FILL)		
10	5	SS	24	24	Silty Fine to Medium SAND, Greenish Gray, Wet, Loose (SM)	100	33, 32, 16, 8, 16
					Silty Fine to Medium SAND, Contains Mica, Medium Gray, Moist, Medium Dense (SM)		
15					END OF BORING @ 10.0'	95	
20						90	
25						85	
30						80	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

▽WL 6.0' WS OR WD	BORING STARTED 05/23/02	ASPHALT/STONE 2.5"/4.0"	
▽WL(AB) ▽WL(AC)	BORING COMPLETED 05/23/02	CAVE IN DEPTH ● 7' @ 24 HRS 4.0'	
▽WL	RIG TRUCK FOREMAN RICHARD	DRILLING METHOD HOLLOW STEM AUGER	

APPENDIX III

UNIFIED SOIL CLASSIFICATION SYSTEM AND REFERENCE NOTES

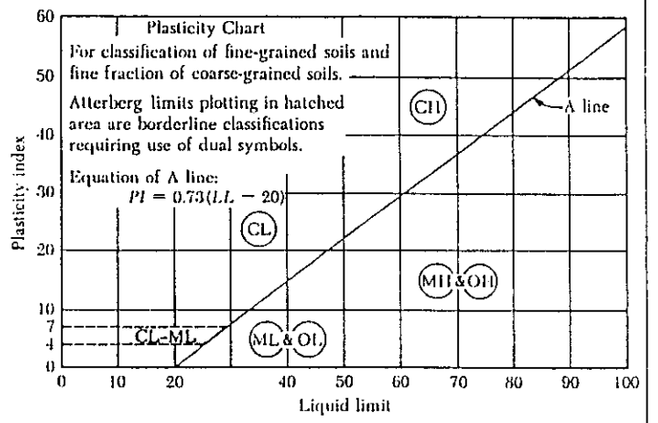
UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

Table Unified System of Classification

Major divisions			Group symbols	Typical names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Table (Continued)

Classification criteria		
Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5% to 12% pass No. 200 sieve Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for GW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	
	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
	Not meeting both criteria for SW	
	Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
	Atterberg limits plot above "A" line and plasticity index greater than 7	



Visual-manual identification, see ASTM Designation D2488.

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

SS - Split Spoon Sampler	DC - Dutch Cone Penetrometer	PM - Pressuremeter	BS - Bulk Sample of Cuttings
ST - Shelby Tube Sampler	PA - Power Auger (no sample)	WS - Wash Sample	RB - Rock Bit Drilling
RC - Rock Core; NX, BX, AX	HSA - Hollow Stem Auger		

Standard Penetration Test (SPT) refers to the blows per foot of a 140 lb hammer free falling 30 inches on a 2 in. O.D. split-spoon sampler, as specified in ASTM D-1586. The SPT blow count is commonly referred to as the N-value. Typically the split-spoon sampler is driven to depths of 18 to 24 inches. The SPT result, N-value, is commonly determined by summing the second and third 6-inch increments.

II. Correlation of Penetration Resistances to Soil Properties:

COHESIVE SOILS
(CLAY, SILT and COMBINATIONS)

CONSISTENCY	SPT, N (Blows/Foot)	UNDRAINED SHEAR STRENGTH C, (PSF)
VERY SOFT	< 2	<250
SOFT	3 - 5	250 - 500
MEDIUM STIFF	6 - 10	500 - 1000
STIFF	11 - 15	1000 - 2000
VERY STIFF	16- 30	2000 - 4000
HARD	> 31	> 4000

NON-COHESIVE SOILS
(SAND, GRAVEL, SILT and COMBINATIONS)

DENSITY	SPT, N (Blows/Foot)	RELATIVE DENSITY (%)
VERY LOOSE	< 5	0 – 15
LOOSE	6 – 10	16 – 35
MEDIUM DENSE	11 – 30	36 – 65
DENSE	31 – 50	66 – 85
VERY DENSE	51 – 80	86 – 98
EXTREMELY DENSE	> 81	99 - 100

[Particle Size Identification]:

• Boulders:		8 inch diameter or more
• Cobbles:		3 to 8 inch diameter
• Gravel:	Coarse	1 to 3 inch
	Medium	1/2 to 1 inch
	Fine	1/4 to 1/2 inch
• Sand:	Coarse	2.00 mm to 1/4 inch (diameter of pencil lead)
	Medium	.42 mm to 2.00 mm (diameter of broom straw)
	Fine	.074 mm to .42 mm (diameter of human hair)

III. Water Level Measurement Symbols:

WL - Water Level	WS - While Sampling	WD - While Drilling	ACR - After Casing Removal
WCI - Wet Cave In	DCI - Dry Cave In	BCR - Before Casing Removal	

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding drilling fluids in a granular soil. In clays and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases additional methods of measurement are generally applied.

APPENDIX IV

SUMMARY OF LABORATORY TEST DATA

Engineering Consulting Services, Ltd.

Richmond, Virginia

Laboratory Testing Summary

Date:06/27/02

Project Number: 7289 **Project Name:** Mcguire AFB

Project Engineer: D.J.S **Principal Engineer:** J.C.D. **Summary By:** K.H

Boring Number	Sample Number	Depth (feet)	Moisture Content (%)	AASHTO	USC	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction		CBR Value	Other
										Maximum Density (pcf)	Optimum Moisture (%)		
B-1	S-3	4.0'-6.0'	13.2	*	SM	*	*	*	19.1	*	*	*	*
B-1	S-7	18.0'-20.0'	31.1	*	SM	*	*	*	34.8	*	*	*	*
B-2	S-5	8.0'-10.0'	16.1	*	SM	*	*	*	23.9	*	*	*	*
B-2	S-7	18.0'-20.0'	28.8	*	SM	*	*	*	33.6	*	*	*	*
B-3	S-4	6.0'-8.0'	*	*	SM	*	*	*	*	*	*	*	*
B-3	S-5	8.0'-10.0'	*	*	SM	*	*	*	*	*	*	*	*
B-3	S-6	13.0'-15.0'	24.1	*	SP-SM	*	*	*	9.2	*	*	*	*
B-4	S-3	4.0'-6.0'	11.6	*	SM	*	*	*	23.4	*	*	*	*
B-4	S-9	28.0'-30.0'	38.7	*	CL	37	22	15	*	*	*	*	*
B-5	S-4	6.0'-8.0'	23.6	*	SM	*	*	*	23.9	*	*	*	*
B-6	S-3	4.0'-6.0'	17.7	*	SM	*	*	*	15.1	*	*	*	*
B-7	S-4	6.0'-8.0'	23.3	*	SM	*	*	*	16.7	*	*	*	*
B-7	S-9	28.0'-30.0'	37.5	*	ML	45	29	16	*	*	*	*	*
B-8	S-3	4.0'-6.0'	19.0	*	SM	*	*	*	18.7	*	*	*	*
B-8	S-4	6.0'-8.0'	21.8	*	SP-SM	*	*	*	11.2	*	*	*	*
B-9	S-3	4.0'-6.0'	19.8	*	SM	*	*	*	15.8	*	*	*	*
B-9	S-5	8.0'-10.0'	31.0	*	SM	*	*	*	31.4	*	*	*	*
B-10	S-3	6.0'-8.0'	*	*	SM	*	*	*	*	*	*	*	*
B-10	S-5	8.0'-10.0'	*	*	SM	*	*	*	*	*	*	*	*
B-10	S-6	12.0'-15.0'	15.7	*	SM	*	*	*	38.1	*	*	*	*
B-10	S-7	18.0'-20.0'	30.6	*	SM	*	*	*	19.6	*	*	*	*
P-1	CBR-1	0.0'-5.0'	*	A-2-4	SM	*	*	*	16.9	123.8	8.6	43.3	*
P-2	CBR-2	0.0'-5.0'	*	A-2-4	SM	*	*	*	19.7	128.4	8.2	53.0	*
P-3	CBR-3	0.0'-5.0'	*	A-2-4	SM	*	*	*	12.9	133.1	7.0	51.7	*

Summary Key:

V = Virginia Test Method
S = Standard Proctor
Hyd = Hydrometer
Con = Consolidation
UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
OC = Organic Content
SA = See Attached